AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

ECONOMIC GROWTH CENTER

YALE UNIVERSITY

P.O. Box 208629
New Haven, CT 06520-8269
http://www.econ.yale.edu/~egcenter/

CENTER DISCUSSION PAPER NO. 914

Rural Financial Markets in Developing Countries

Jonathan Conning
Hunter College, City University of New York

and

Christopher Udry
Yale University

June 2005

Notes: Center Discussion Papers are preliminary materials circulated to stimulate discussions and critical comments.

Prepared for *The Handbook of Agricultural Economics*, Vol. 3, Agricultural Development: Farmers, Farm Production and Farm Markets, edited by Evenson, R.E., P. Pingali, and T. P. Schultz. Last edited: June 20, 2005.

This paper can be downloaded without charge from the Social Science Research Network electronic library at: http://ssrn.com/abstract=756965

An index to papers in the Economic Growth Center Discussion Paper Series is located at: http://www.econ.yale.edu/~egcenter/research.htm

Rural Financial Markets in Developing Countries

Jonathan Conning and Christopher Udry

This review examines portions of the vast literature on rural financial markets and household behavior in the face of risk and uncertainty. We place particular emphasis on studying the important role of financial intermediaries, competition and regulation in shaping the changing structure and organization of rural markets, rather than on household strategies and bilateral contracting. Our goal is to provide a framework within which the evolution of financial intermediation in rural economies can be understood.

JEL codes: O16, Q14, O17, O12

Keywords: Rural Finance, Financial Intermediation, Agricultural Credit

Chapter 15
RURAL FINANCIAL MARKETS IN DEVELOPING COUNTRIES

JONATHAN CONNING
Department of Economics, Hunter College, City University of New York, New York, NY

CHRISTOPHER UDRY
Department of Economics, Yale University, New Haven, CT

Table of Contents

1 Introduction 2
2 Salient Characteristics of Rural Financial Markets 6
2.1 Fragmented or absent markets 6
2.2 Government Interventions 11
3 Models of Rural Financial Markets 20
3.1 The complete markets benchmark 22
3.2 Empirical tests of efficient risk sharing 25
3.3 Consequences of imperfect financial markets 26
3.4 Contracting under asymmetric information and imperfect enforcement 32
3.5 Moral Hazard 35
3.6 Multi-period and Repeated Contracts, Limited Commitment, and Reputation 40
3.7 Limited Liability, Collateral and its Substitutes 48
3.8 Property rights and credit supply 55
4 Rural financial intermediaries 57
4.1 Crowding-in vs. Crowding-out of Financial Services 66
4.2 Group Loans, Cooperatives, ROSCAs, and Mutuals 69
4.3 Policies to promote rural financial intermediation 73
5 Conclusion 75
Bibliography 77

Prepared for *The Handbook of Agricultural Economics*, Vol. 3, Agricultural Development: Farmers, Farm Production and Farm Markets, edited by Evenson, R.E., P. Pingali, and T. P. Schultz. Last edited: June 20, 2005.

1 Introduction

The organization of rural economic activity in general, and agricultural production in particular, is strongly conditioned by the fact that inputs are transformed into outputs with considerable time lags, and that production and sale outcomes can be highly uncertain because of the vagaries of nature or the swings of volatile commodity markets. In such environments, the ability of agricultural enterprises and rural households to make long-term investments, take calculated risks, and create stable consumption streams will be shaped by the set of available financial instruments and strategies to transform one pattern of variable and uncertain resource inflows and outflows into another. If the available set of financial services is very limited, households may have to forego valuable investment and income-generating activities and suffer the consequences of volatile consumption.

Financial transactions are implicit within, and often the reason behind, many contractual and organizational forms in the rural economy. Financial innovation therefore can have dramatic consequences on the ownership and governance structures of agricultural firms and community institutions. Financing options can affect decisions such as the physical placement and scale of agricultural operations, crop choices, and the decision to invest in risky but profitable new technologies or infrastructure. They may also affect choices about the size and composition of the rural household, and decisions such as whether to migrate, how much to invest in education, or the use of child labor. The availability of financing can also be a force that shapes political dynamics within a community, for example by affecting agent's outside opportunities and bargaining power.

Making new financial services and contract forms available can be viewed as a form of opening to trade. Agents in a financially isolated rural economy have little choice but

to transform one set of variable and uncertain cash flows into another using available production and storage technologies and local financial instruments. Since risks in a local rural economy are typically subject to common external shocks and the pool of savings may be limited, local markets often cannot offer very good diversification opportunities and the cost of funds may be high. The introduction of new financial instruments allows agents to face new relative price tradeoffs across time periods and state-contingent events. The new trading opportunities this creates may then allow agents to specialize in higher value income activities while at the same time allowing households to purchase smoother consumption streams. Unfortunately, agents in the rural sectors of most developing countries remain cut-off from many of the opportunities for investing, risk-taking and risk spreading that would be available through better financial integration into larger national and global financial markets (de Soto 2000).

An important research agenda is to understand the dynamics of financial innovation. There are both winners and losers from the introduction of new financial services and opportunities for trade. Losers may include incumbent local financial service providers who may stand to lose monopoly rents or market share in the face of increased outside competition (Rajan and Zingales 2003; Platteau 1997), or those who might fear for the collapse of local informal insurance mechanisms (Scott 1976). Just as common have been the calls by organized groups of borrowers or activists for political and economic authorities to intervene to regulate allegedly exploitative or harmful activities of informal moneylenders or landlords.

Whether these fears were in reality justified or not, these constituencies, or those who would claim to speak for them, have often led political movements that have

opposed financial market liberalization or have lobbied to favor government interventions in rural finance. In many cases a history of heavy-handed political interventions has led rural financial markets to become repressed and distorted (Gurley and Shaw 1960; Adams, Graham, and Von Pischke 1984; Gonzalez-Vega 1984; McKinnon 1973). Yet even where financially repressive policies have been lifted or never materialized, the entry of new financial intermediaries to help local communities realize the gains to financial trade has often proven difficult or been delayed because serious information asymmetries and enforcement problems lead to market failures that are difficult to repair. For all these reasons observers continue to disagree on the role of government in promoting or repressing efficiency-enhancing financial intermediation.

There are already several very useful surveys and edited volumes of articles covering important aspects of the now vast literature on rural financial markets and household consumption behavior in the face of risk and uncertainty. A non-exhaustive list of key survey references might include Von Pischke et al. (1983), Binswanger and Rosenzweig (1986), Hazell et al (1986), Bell (1988), Gersovitz (1988), Besley (1994), Stiglitz (1994), Townsend (1995), Morduch (1995), Meyer and Nagarajan(2000), Barry and Robison (2001), Banerjee (2003), Fafchamps (2003), Dercon (2004), Armendariz de Aghion and Morduch (2005) and the relevant chapters in Bardhan (1989), Basu (1997), Deaton (1997), Ray (1998), and Bardhan and Udry (1999). While considerable overlap with these earlier studies is inevitable in the present work, we have attempted to set this chapter somewhat apart by focusing in more depth on relatively new developments in this fast growing field of empirical and theoretical research. We have also attempted to place more emphasis than earlier studies on studying the important role of financial

intermediaries, competition and regulation in shaping the changing structure and organization of rural markets, rather than simply focusing on household strategies and bilateral contracting.

What then determines the extent and efficacy of the financial instruments available to the rural economy? All financial transactions involve in one way or another the exchange of contingent claims over future resources for claims in the present, in other words they involve the sale and purchase of contingent promises or IOUs. Like many other surveys before this, we shall highlight the many difficulties that arise in buying and selling such IOUs, particularly in rural environments where problems of asymmetric information and costly enforcement are likely to be important. What we hope distinguishes this survey is our focus on the process by which the financial structure of the rural economy is transformed by financial intermediaries.

Intermediaries play an essential role in the dynamic evolution of the real production and exchange possibilities of the economy by creating new instruments and contractual forms to bridge many of the trading gaps and missing markets that information and enforcement problems create. Financial intermediaries use their own capital and specialized information and enforcement mechanisms to help transform the illiquid claims held by producers and entrepreneurs in the economy into more liquid claims that can be more readily sold to less informed investors with funds. Successful contractual forms are soon imitated and improved by new entrants and in the process new markets are developed and extended. Further opportunities for trade and specialization may be uncovered along the way, and with them, a new set of information and enforcement problems to be solved.

Whether such a virtuous circle of uncovering and completing new markets proceeds or gets stuck will depend on the nature of the underlying information and enforcement problems and on the quality of a society's laws and institutions. These affect the incentives agents have to gather information and search for new contract forms to establish, monitor and enforce the new property claims that form the basis for emergent markets and trades.

Efficiency-enhancing private intermediation is more likely to emerge in environments where individuals are able to create new instruments and contracts that are given legal or societal recognition and are impartially enforced. By contrast, in situations where property rights are hard to enforce agents will find it difficult to define and secure the commitments that allow them to appropriate the returns from searching for and completing mutually beneficial trade. Our goal is to provide a framework within which the evolution of financial intermediation in rural economies can be understood.

We begin in section 2 with a brief discussion of prominent features of rural financial markets that will guide our subsequent arguments. Section 3, the core of the chapter, examines recent developments in the theory of rural financial markets, and where possible links these to relevant empirical literature. Section 4 concludes.

2 Salient Characteristics of Rural Financial Markets

2.1 Fragmented or absent markets

Development economists have spent much effort in recent years trying to measure the extent to which households appear to be insured against idiosyncratic shocks and the structure and performance of local financial contracts such as bilateral credit and insurance arrangements with landlords, moneylenders, family or friends, or group-based

mutual savings and insurance arrangements such as rotating savings and credit associations (ROSCAs). While these studies have advanced our understanding of local bilateral financial contracting and mutual insurance within poor communities, the study of financial *intermediation* has remained relatively neglected. A financial intermediary expands and transforms the set of trades that can take place both within communities and across communities by carrying out monitoring and control activities and providing asset transformation services at lower cost than what could be achieved under a system of local bilateral contracts or mutual insurance arrangements (Diamond 1996).

Rural financial markets have often times been described as *fragmented* in the sense that different segments of borrowers are observed to be systematically sorted across different loan types and lending intermediaries according to the characteristics of the borrowers, the lenders and the activities financed, and other variables in trading environment (McKinnon 1973; Hoff, Braverman, and Stiglitz 1993; Meyer, Nagarajan, and Hushak 1997). Through a combination of limited access and choice, firms in the same market end up using financial instruments that can substantially differ as to interest rate charges, the type and quantity of collateral required on loans, resources spent on monitoring and enforcing contract terms, and whether or not credit is tied to transactions on other markets. In some markets, would-be borrowers may find themselves excluded or dissuaded from obtaining access to certain credit instruments, or rationed to smaller loans than they might have optimally chosen, by collateral requirements and other non-price terms. They may then adjust by turning to substitute, but possibly more expensive financing sources or may modify their first best allocation plans in other ways.

Banerjee (2003) provides a very useful review of some of the salient empirical literature on rural financial markets. He argues (p. 4) that there is "extreme variability in the interest rate charged by lenders for superficially similar loan transactions within the same economy." Aleem (1990) similarly shows that moneylenders in a semi-urban setting in Pakistan charged highly variable interest rates to different borrowers: the standard deviation of interest rates was 40% per annum, while the average rate was 80%. Timberg and Aiyar (1984) document that Shikarpuri lenders in India charged rates varying between 20% and 120%, depending on the market. Dasgupta (1989) reports high variation in the rates charged by moneylenders, with substantial numbers of loans made at rates higher than 60%, while many others are made at rates below 30% Ghate (1992) cites results from a case study from Thailand which finds interest rates of 2-3 percent per month in the Central Plain, but 5-7 percent p.m. in the North and Northeast. Udry (1991) finds large variation in interest rates within 4 small villages of northern Nigeria: nominal monthly interest rates exceeded 7.5 percent on about 20 percent of loans, but the median nominal interest rate was 0 percent.

Banerjee (2003) also reports substantial evidence of very large spreads between borrowing and deposit rates in many financial markets in developing countries. Timberg and Aiyar (1984) report spreads of approximately 16 percent, while Aleem (1990) reports a spread of over 40 percent in Pakistan. Ngugi (2001) shows that the spread in Kenya in the late 1990s ranged between 15 and 30 percent. In rural southern Ghana, deposit takers charge a fee to depositors, and pay no interest, while loans are made at variable rates up to 10 percent per year (Aryeetey and Udry 2000).

There is also strong and growing evidence that many enterprises, particularly rural enterprises, have very high rates of return to capital that may persist over time for some enterprises because of the highly fragmented nature of financial markets. Schündeln (2004) shows that the marginal rate of return for small firms in Ghana is about 50 percent, while the return for large firms is less than 10 percent. Mckenzie and Woodruff (2004) find that the rate of return is as high as 15 percent per month for microenterprises in Mexico. Banerjee and Duflo show that a sample of medium sized firms that borrow from a large Indian bank have rates of return of almost 100 percent per year. Goldstein and Udry (1999) estimate the rate of return to capital for farmers entering pineapple production to be over 1200 percent per year. These examples, of course, could be multiplied.

The key challenge of theoretical work on rural financial markets, therefore, is to provide a framework to make sense of these striking features of rural financial markets. Why are there such high rates of return to capital for at least many borrowers? How do large spreads persist between deposit and borrowing rates? Why is there such a diversity of contract forms and intermediary structures? How are different households and firms matched to each, and why do such highly variable interest rates persist in equilibrium across borrowers?

Moneylenders and financial intermediaries in the rural economy include most importantly input suppliers, rural product traders (including agro-industry and exporting firms), and banks. They often invest heavily in screening and monitoring their clients, and may also intervene to significantly shape their clients' choice of technology and other

production decisions. Writing in the early 20th century, British colonial officer Sir Malcolm Darling (1925) had this to observe about the rural moneylender of Punjab:

> "He is always accessible, even at night; dispenses with troublesome formalities, asks no inconvenient questions, advances promptly, and if interest is paid, does not press for repayment of principal. He keeps in close personal touch with his clients, and in many villages shares their occasions of weal or woe. With his intimate knowledge of those around him he is able, without serious risk, to finance those who would otherwise get no loan at all."

Traders and contract farming firms typically contract to market or process a farmer's harvest in exchange for credit and often other services like technical assistance and farm input sales. An important characteristic of this form of lending is that the loan contract often involves much less collateral than would a similar bank loan, and at times, no collateral other than a crop pledge. These loans are however usually quite heavily monitored in the growing season and prior to repayment. The purpose appears aimed at limiting the farmer's scope to divert resources or effort away from the financed project and toward other activities where the lender may not be able to establish clear claims. Traders are likely candidates to become financial intermediaries because in the normal course of their activities as product buyers they acquire knowledge of the farmer and the crop technology. While a separate specialized lender and separate trader might both incur costs to monitor a farmer's compliance in meeting the terms of a loan, and in meeting quality standards on delivered produce, a combined trader-lender economizes on these costs through economies of scope in monitoring. They are also often able to better value

some of the items a farmer might provide as collateral. A trader for instance will be much more willing to accept a farmer's crop as collateral than a bank.

Another important aspect of this type of lending relationship is that it is intermediated finance: the trader-intermediary usually employs a combination of her own equity together with funds leveraged from less informed outside intermediaries such as banks or other creditors such as the downstream product-buying intermediaries to whom they will themselves deliver product. This type of relationship is often underpinned by, or leads to the development of, a system of bills of exchange. At the time of contracting the trader may have the farmer sign a bill of exchange for the amount of funds to be advanced. The intermediary then uses the diversified collection bills obtained from many farmers as a form of proof of contracting or security to use in raising finance from the bank or outside lender. The outside creditor(s) may then lend the intermediary a fraction of the funds required to on-lend to the farmers, using these bills and other guarantees as security. By lending only a fraction of the total required finance, the outside lender forces the intermediary to make up the difference out of her own equity thereby acquiring a sufficient stake in the borrower's project to have the incentive to monitor the farmer in ways that safeguard the value of the overall investment.

2.2 Government Interventions

Governments have intervened in rural financial markets since the earliest days of markets. Hammurabi's codes, a set of 282 laws set in stone by the ruler of Babylon and Mesopotamia over 37 centuries ago included many to regulate the operation of credit for farmer and merchants, including caps that limited interest rates to 33 and one third percent on loans of grain and regulations that limited what could be collected on

agricultural debts in the event of drought or certain other natural disasters (Goetzmann 1996).

Some types of government intervention can clearly serve the useful purpose of promoting financial market trade between private parties. For example transaction costs between private parties may be reduced if the state is able to provide impartial and accessible legal mechanisms for the arbitration and enforcement of contracts. Similarly, the prudential regulation and supervision of deposit-taking financial intermediaries may promote deposit mobilization and encourage efficiency-enhancing market competition between banks. Even some forms of more direct government intervention, including direct loans and government loan guarantees, may arguably at times help 'crowd-in' private sector financial intermediation or provide efficiency enhancing financial services in contexts where private sector actors may have otherwise been reluctant to operate.

Even in advanced economies, governments sponsor or directly support elaborate farm lending systems. In the United States, the Farm Loan Act of 1916 established the first government-sponsored enterprise via the creation of a system of regional Farm Loan Banks to grant loans to farm cooperative associations that lend directly to farmers. In 2001 the Farm Credit System stood behind some 91 billion dollars of loans or about 30 percent of farm sector's total loans outstanding (General Accounting Office 2001). The system continues to enjoy implicit and explicit government guarantees and tax benefits that enhance the financial services cooperative institutions ability to raise funds.

At other times, government involvement has been much more heavy-handed. Governments have, for example, enforced strict 'anti-usury' laws that capped market interest rates or acted to prohibit or constrain the participation of certain types of

intermediaries. Directed credit programs have compelled national banks to open rural branches and allocate a specified fraction of total lending to agricultural lending. For decades, state-sponsored finance was the dominant form of institutional lending in most developing countries, although access by different strata of farmers varied greatly by region. A 1975 World Bank Report on Agricultural Credit, written at about the height of the Bank's lending for agricultural lending, noted that less than 1 percent of farmers in certain African farmers obtained access to subsidized lending, whereas in a country like Taiwan almost all farmers had access (World Bank 1975). The report also noted that in Latin America and Asia it was not uncommon for 70 to 80 percent of small farmers to have virtually no access to such credit. Where such farmers did have access to institutional credit, it had generally been used for short-term loans to finance current inputs, such as seed, fertilizer and pesticides. Although institutional lines of credit to buy animals, tractors or equipment are sometimes provided over a period of two to five years or longer, longer-term institutional credit has typically remained scarce (Deininger 2003).

A large literature has made clear that financial repression as a result of directed credit, interest rate caps, and excessive regulation and state involvement in banking has been a principal culprit of the relative lack of more effective intermediation in developing countries (Adams, Graham, and Von Pischke 1984; McKinnon 1973). Although often well-intentioned, these policies often created extremely poor incentives for private financial intermediaries to enter the sector or to make sensible loans. State lending programs on the other hand were very often characterized by high arrears and political capture. Cole (2004) finds that over the 1985-1999 period, agricultural lending by public banks in India grew 5-10 percentage points faster in election years than in years after an

election, that election year loans were more likely to be made to districts with more heavily contested elections, that these loans were less likely to be repaid, and that they did not measurably affect agricultural output. Warning and Sadoulet point to similar evidence of political capture and loan arrears in Senegal (1998).

Interest rate ceilings have been a particularly common intervention in rural financial markets. The traditional analysis of interest rate ceilings is that, by limiting supply and increasing demand, such interest rate caps will create an artificial excess demand for credit, leading lenders to ration supply. While interest rate caps clearly harm savers and will lead to reduced rural deposits, the impact on farm borrowers is *a priori* ambiguous since what an individual farmer loses by receiving a smaller loan may be more than compensated for by a lower interest rate. It is clear however that in many, if not most cases, the resulting rationing has often ended up favoring larger farmers at the expense of smaller ones. Many country case studies have similarly observed that the lion's share of subsidized institutional credit goes to medium and large farms, even though many of these programs are justified politically as ostensibly being aimed at helping small farmers (Adams, Graham, and Von Pischke 1984; Von Pischke, Donald, and Adams 1983; Burgess and Pande 2003). This outcome has been found to be so common that Claudio Gonzalez-Vega (1984) has dubbed it 'the Iron Law of Interest-Rate Restrictions.'

Several explanations have been offered. One explanation is that if under market conditions higher interest rates must be charged of smaller farmers to recover fixed loan processing costs, legal interest rate caps will lead lenders to ration these farmers first. Since capped rate loans transfer rents to farmers lucky enough to obtain them, the credit allocation process is also susceptible to political capture, and larger farmers will typically

have the upper hand. Bates (1981) gives historical details of the pattern of political capture of marketing boards which also often direct subsidized credit toward better off farmers. Explicit corruption in the allocation of low-interest loans was also common. State-owned financial institutions were often confronted with only a soft budget constraint, and received repeated financial bailouts, further reducing the incentive to put resources into enforcing contracts or mitigating problems of asymmetric information. In this context, a movement away from bad policies is a far more important step than any pressing need for policy innovation (Adams 1992; Adams, Graham, and Von Pischke 1984; Von Pischke 1997; McKinnon 1973; Rajan and Zingales 2003).

Directed credit programs have been similarly strongly criticized as being distorting and inefficient and usually part of a package of other financial repression measures that set back the development of many rural financial markets (Adams, Graham, and Von Pischke 1984). Although these criticisms no doubt hit the mark in describing the impact of policies in many countries, other researchers have pointed to evidence suggesting that directed credit has had several of its intended effects in some contexts. For example the Bank of Thailand (BOT) mandates portfolio allocation targets for commercial banks to lend to the agricultural sector. These include mandates to charge interest rates for agriculture not higher than non-agriculture lending and government efforts to expand the capitalization of the Bank for Agriculture and Agricultural Cooperatives (BAAC), which has facilitated the aggressive expansion of BAAC activities. There is substantial evidence of important positive impacts of this expansion on agricultural output and farmer welfare (Fitchett 1999).

A recent study by Burgess and Pande (2003) reviews the literature on directed credit in India and analyzes a panel of state-level data to conclude that directed credit policies had the intended effect of expanding rural bank branching and that this lowered poverty and expanded non-agricultural rural output while leaving urban policy unaffected. As the authors note, at the time of independence less than one percent of rural household debt in India came from commercial banks and the vast bulk of rural borrowing was via informal sources, with moneylenders accounting for close to seventy percent of the total. By 1971 the share of debt to commercial banks had grown scarcely to 3 percent. A Central Bank mandate adopted between 1977 and 1990 which required banks to open up four new branches in under-served areas for every new branch opened elsewhere led to significant expansion of new rural branches, which varied by state. Largely as a result of these policies by 1991 the share of rural debt held by commercial banks had increased tenfold to 29 percent, while the moneylender share of rural household debt more than halved from 35 to 15.7 percent. After carefully controlling for other factors, the authors find that rural non-farm activities expanded, wages rose, and rural poverty fell relatively more in areas in which banking services expanded relatively quickly as a consequence of this policy of directed credit.

The debate over this issue is rather like the debate over trade policies. There is little doubt that protectionism and industrial policy can lead to inefficient distortions in relative prices that lowers welfare and suppresses trade, but the experience of a few countries has lead some observers to believe that such policies may at times be used to address market failures and/or to break local market power. Similarly, despite the overall record of

costly failure, it is clear that directed credit policies may serve valuable social objectives in the right circumstances.

The apparent failure of many programs of state intervention in rural financial markets, and the wave of structural adjustment programs that moved through developing countries beginning in the 1980s did away with much of the legacy of financial repression. The policy change was dramatic. For example, annual World Bank lending for agricultural credit projects was over US$ one billion in the 1980s, but fell to under $250 million by the end of the 1990s (Zeller 2003). There was large-scale privatization, restructuring and closure of many state banks. This was associated in many countries with more widespread liberalization of rural financial markets. The reduction of financial repression was usually associated with a package of other reforms including trade liberalization and privatization of other state-owned enterprises. These reform packages led to new financial intermediaries in many cases, but nowhere near the supply response that the most optimistic 'financial repression' school people predicted (Carter, Cason, and Zimmerman 1998).

It is evident that that the development of a robust rural financial system requires both careful state attention to the fundamental institutions that undergird financial contracts, and the freedom to transact without direct state regulation (Stiglitz 1994; Rajan and Zingales 2003). Section 3 of this chapter is devoted to providing a framework to understand the role of public goods in property rights and contract enforcement, information sharing, and prudential regulation.

The task of promoting, improving or even creating the rural institutions required to support rural financial transactions is one of the fundamental challenges facing

governments of developing countries. The range of feasible financial contracts can be expanded in the presence of institutions for information dissemination or that facilitate the verifiability and enforceability of contracts. More specifically, governments have a crucial role to play in the creation and support of reasonably impartial courts to enforce private contracts and arbitrate or settle disputes, records offices to register and title property and increase the collateralizability of assets and the registration of liens, credit bureaus to record and share credit histories, and external audit mechanisms to solve problems of verifiability. Some of these institutions can be run as government offices, some can be supported as private enterprises, while others might be private but depending on government supervision.

Some might argue that these institutions emerge wherever they are needed. Early neo-classical institutional economics sees contract and institutional innovations emerging to economize on transaction costs and information asymmetries (North and Thomas 1973; Demsetz 1967). This is a generalized induced innovation hypothesis, strongly related to Coasian notions of contracting. But this view has largely been abandoned (North 1990). Dysfunctional institutions can sometimes persist over long periods of time in any particular society, even as other societies have managed to adapt their own institutions to overcome similar problems. The path of institutional change may be strongly influenced by historical precedent and by the workings of political processes (Bowles 2003). In the context of discussing credit market institutions in modern day Africa Fafchamps (2004) discusses innovation failure (institutions may simply not have been invented), authority failure (central government coercion may be weak or misdirected), coordination failure (public goods require the solution to collective action

problems that may remain unsolved). Institutional change may be opposed by those who see themselves as losing out in the new distribution of wealth and political power that may emerge or they may be holding out for a better bargain.

One hypothesis is that institutional failures of this sort are the consequence of the lack of a catalyzing agent or organization to coordinate actions to spur change. This has lead to some hope that state banks and government guarantees can contribute by 'crowding in' new forms of private financial intermediation. Alternatively, nonconvexities in the technologies associated with institutional innovation can be associated with institutional failure when there is insufficient local intermediary capital, or a too-small market. In this case, the relative absence of intermediaries may be a simple function of the low levels of income and wealth in developing countries. Some authors argue that growth and financial deepening go hand in hand: as the economy grows there are more opportunities for diversification, and this in turn induces agents to invest in riskier but higher return projects, so the economy grows faster (Acemoglu and Zilibotti 1997).

In order to move towards a theory of the evolution of the institutions that might support a flourishing rural financial sector, we must first understand the economics of financial markets in the context of incomplete information and imperfect contract enforcement. It is to that task that we now turn. We then use this general framework to examine the potential for 'crowding in' of new forms of intermediation, and the role of new semi-formal institutions of microfinance.

3 Models of Rural Financial Markets

Historically, a good part of the theory of rural financial transactions developed in parallel to, and sometimes ahead of, more general results in the literature on information asymmetries, and the microeconomic theory of banking and corporate finance (Stiglitz 2002).[1] For example, Stiglitz' (1974) famous paper on "Incentives and Risk sharing in Sharecropping" inspired a good deal of later literature on how moral hazard could shape the structure of labor, insurance and credit and equity contracts, and Akerlof's (1970) early analysis of adverse selection or the 'lemons problem' was, by his own account, partly motivated by his observations on the operation of informal rural moneylenders in India.

In attempting to survey developments in the theory of agricultural financial contracting it is helpful to make one small preliminary note on methodology on how it relates to a more general microeconomic theory of contracts. The early literature on agricultural contracts that developed in the 1970s and 1980s worked extensively with what is sometimes referred to as the *state-space* formulation (Hart and Holmstrom 1987) and with linear contract forms. A typical model might describe farm project outcomes by $x = \theta f(e)$ where e is the agent's level of input or effort into production the function $f(e)$ and θ is a multiplicative random shock drawn by 'nature' from a known probability distribution $G(\theta)$. If an outside principal (e.g. a landlord or a lender) with a stake in the project could not directly to specify the farmer's choice of e in a contract, then the principal could not be sure if a low project outcome x was due to a bad draw of θ or to the farmer's low choice of e, leading to a potential problem of moral hazard. The

[1] Freixas and Rochet (1997) provide an excellent survey of the modern literature on the microeconomics of banking and corporate finance while Dewatripont and Tirole (1994) offer a useful synthesis of the theory of prudential government regulation and intervention in financial markets.

analysis then turned on finding the terms of a contract or sharing rule that would give the farm agent incentives to choose a given effort level anyways. A linear contract of the form $\alpha x - F$, was typically assumed where α is the share or output kept by the farmer, and F is the value of a fixed payment made either from the farmer to the principal or vice-versa. The linear formulation seemed rich enough to span a broad range of recognizable contracts forms including fixed-wage contracts $(\alpha = 0, F < 0)$, fixed-rent or fixed-debt contracts $(\alpha = 0, F > 0)$, pure share-contracts $(\alpha > 0, F = 0)$ and mixed share contracts with side lump sum transfers $(\alpha > 0, F \neq 0)$. The main advantage of the state-space formulation was that it presented technology in a familiar way that could be built directly upon existing farm household models (Singh, Squire, and Strauss 1986).

By way of contrast, the more general microeconomic theory of contracts has tended to increasingly work with what has come to be known as the *parameterized distribution* formulation pioneered by (Mirrlees 1976) and further explored by Holmstrom (1979) and others. In this formulation, the agent's effort choice *e* is thought of as a parameter in the distribution of project outcomes $\pi(x_s; e)$. Through his choice of *e* the agent chooses or 'induces' a probability distribution over state-contingent outcomes x_s where *s* indicates a state of the world. This formulation abandons linearity and generalizes the production function. Although the two formulations are equivalent in so far as they can be mapped onto one another, the latter formulation has led to more general insights and now clearly dominates the field. The parameterized distribution formulation also makes it easier to work with richer contracting environments -- for example tying the agent's reward not just to the outcome of their own project but to other events in the village – rather than just

simple sharing rules that assume linearity.[2] For all these reasons we shall use the parameterized distribution approach to survey the literature, even where results were first cast using the state-space approach.

3.1 The complete markets benchmark

It is useful to begin with a brief review of the operation of credit and insurance markets under the assumption of complete markets. Although this is not realistic in most contexts, more appropriate models of financial contracting can be understood as departures from this benchmark case. Consider a village of N farmers, where we use the term 'village' very broadly as a metaphor for any group of individuals who are able to engage in financial trade. It could refer to a small group of farmers tied together by geographic proximity, members of an extended family or expanded trading circle. Each time 'period' will be divided into two stages, a 'pre-harvest stage' where investments are made and state-contingent contracts are exchanged but in which no production or consumption takes place and a second 'harvest and post-harvest stage' where project outcomes are realized, contracts are executed, and consumption takes place.

Villager j has access to a farm production project that will yield stochastic harvest income x_{js} where where $s = 1..S$ indexes possible states of the world and these states are distributed according to the probability distribution π_{js} that may be affected by the input and effort choices made by each of the agents in the village, which for the moment are assumed to be costlessly observed and contractible. To illustrate, if each villager's harvest project yielded one of M possible harvest incomes then there would be $S=N^M$

[2] As explained below, this has had some important consequences, for example interpretations that were derived under the state-space approach that had to be later abandoned or modified once the same problem was explored in a less restricted contracting environment.

possible ways harvest outcomes might be realized within the village. We could label each of these realizations as a state-contingent event or state of the world *s*, although properly speaking the event space should be far richer. A state of the world is a complete description of a possible outcome of uncertainty. For example, a particular pattern of harvest realizations in which a particular child in a particular farm household falls sick should properly be considered a separate state of the world from an outcome with the exact same pattern of crop realizations but where the same child does not fall sick.

Let c_{js} represent consumption of villager *j* in state *s* and suppose that each individual wants to maximize expected utility $\sum_s \pi_s u_j(c_{js})$ where u_j is a standard concave and well-behaved utility function. A Pareto-efficient allocation of risk in the village can then be found by maximizing the weighted sum of the utilities of each of the *N* villagers, where λ_j is the individual's weight in the Pareto program. These reflect the relative strength of the entitlement that each individual has over village resources. In a non-market setting these would be given perhaps by their social status or entitlement standing within the community (Sen 1982). In a competitive market setting these weights would be related to the market value of their initial property claims x_{js}. A Pareto efficient allocation is found by choosing the c_{js} to solve

$$\sum_{c_{js}} \lambda_j \sum_s \pi_s u_j(c_{js}) \tag{1.1}$$

subject to village-wide resource constraints in each state

$$\sum_j c_{js} \leq \sum_j x_{js} \quad \forall s \tag{1.2}$$

The familiar first-order conditions for an optimum yield the following condition relating the marginal utilities of any two villagers *j* and *k* in any state of the world *s*:

$$\frac{u_j'(c_{js})}{u_k'(c_{ks})} = \frac{\lambda_k}{\lambda_j} \qquad \forall j,k,s \tag{1.3}$$

Since the $\lambda's$ are constant welfare weights the conditions imply that marginal utilities of all villagers must move together. From this it follows that each household's consumption will be monotonically increasing in the level of average village consumption. Idiosyncratic shocks to household income will be pooled at the village level so that, conditional on average consumption, a household's consumption will be unaffected by its own idiosyncratic income. The ability to accomplish such efficient risk sharing presupposes of course the existence of elaborate mechanisms to verify states and efficiently side-contract to redistribute resources between individuals in every state of the world. In a market setting this requires the existence and efficient operation of *S-1* separate competitive asset markets to span the entire state-contingent commodity space. This is quite a requirement.

The framework above can be readily extended to multiple time periods in the fashion of Arrow and Debreu (1954) to allow state and time contingent income and consumption levels. Efficiency conditions similar to (1.3) would hold across time and states of nature. This implies village institutions will pool resources to buffer individuals from all idiosyncratic shocks and allow individuals to efficiently smooth consumption over time and in response to all idiosyncratic shocks. All profitable investment projects would be financed[3] and full 'separability' (Singh, Squire, and Strauss 1986) between household consumption and production decisions could be achieved. A version of the Modigliani-Miller Theorem also holds: in a world of complete markets the financial structure of the farm and of the economy more generally becomes both indeterminate and irrelevant. Just

[3] Where profitability would be measured by the village's internal efficient market rate of return.

as there are an infinite number of sets of linearly independent vectors that can span a vector space of dimension *S*, there are as many assets that could be traded to span a state-contingent commodity space of the same dimension. Since no prediction can be made as to which of many possible sets of assets will actually be traded, no interesting comparative institutional analysis is possible. More precise predictions about the contractual structure of the economy only emerge if one adds trading frictions.

3.2 Empirical tests of efficient risk sharing

Few economists believe that the Arrow-Debreu world of complete markets provides a very accurate description of the global economy. On the other hand, many economists implicitly endorse the idea of efficient risk-sharing at smaller units of analysis, for example whenever they treat households as unitary actors, since this presupposes efficient consumption pooling. The possibility that efficient consumption pooling might be achievable in the somewhat larger unit of an idealized 'village' economy where community members are assumed to have good information about one another enjoys considerable intellectual appeal.

The complete markets model yields a number of hypothesis that researchers have sought to test against empirical data. In a well-cited study of Indian villages, Townsend (1994) regressed household consumption on household income, village aggregate consumption, and a number of other variables. Under the null hypothesis of full risk sharing household consumption ought to be highly correlated to aggregate village income but independent of household specific shocks. His results indicated a considerable amount of risk pooling, but the hypothesis of full consumption smoothing was clearly rejected as individual households' consumptions appear to adjust considerably to

idiosyncratic shocks. Using the same data and more robust methods, Ravallion and Chaudhuri (1997) also conclude that there is evidence against complete risk sharing.

Broadly similar methods have been used to examine risk sharing in a wide range of different social groups, including families, ethnic groups, and neighbors. Examples include Jalan and Ravallion (1998) using data from China, Grimard (1997) using data from Côte d'Ivoire, Suri (2003) using data from Kenya, Kazianga and Udry (2004) using data from Burkina Faso, Dercon and Krishnan (2004) using data from Ethiopia, and Gertler and Gruber (2002) using data from Indonesia. In each case, the hypothesis of Pareto efficient risk sharing within the relevant social group is rejected, though some evidence of partial risk sharing is usually found.

Looking more directly at the transfers between households, Udry (1994) arrived at similar conclusions for households in Northern Nigeria, and Fafchamps and Lund (2003) found evidence of only limited risk-sharing in rural Philippines. Duflo and Udry (2004), Goldstein (2004) and Dercon and Krishnan (2000) report furthermore that they can reject the hypothesis of efficient risk sharing even *within* the same households in rural Côte d'Ivoire, Ghana, and Ethiopia, respectively. All of these studies point to forms of imperfect consumption smoothing and to the existence of more effective risk-sharing within particular subgroups or networks within a village. Kinship, family, clan or religious affiliation may be important because these groups can threaten to impose larger punishments on individuals break commitments to mutual insurance arrangements.

3.3 Consequences of imperfect financial markets

Even if a small tight-knit group could accomplish the feat of efficient risk pooling, individuals would still very likely remain exposed to substantial risks because the very

physical proximity and closeness that is required of agents to be able to enforce state-contingent risk-sharing arrangements will typically expose these individuals to correlated risks. For example, a shortfall of rain is likely to affect most of the agricultural households in the same small dryland farming community. Locals will want to exchange risks with individuals outside of the village.

Since realistically it would quickly become prohibitively costly and complicated for each individual to separately contract directly with each of many hundreds of other individuals spread out over large distances, it is natural to expect this to create demand for the entry of specialized financial intermediaries to help lower the transaction costs of pooling risks and in this way help society to further complete the market and reap the gains to financial trade.

The entry of efficiency-enhancing financial intermediation may however be delayed or complicated for several reasons. The first problem is that outside financial institutions (FIs) are just that: outsiders that may not have the kind of local information and enforcement mechanisms necessary to verify and enforce detailed state-contingent contracts within the village. As reviewed in more detail below, this may end up severely limiting the set of feasible contracts a FI may be willing to offer.

Hence, either because the members of their trading networks face correlated risks and/or because financial contracting is incomplete within villages, households and individuals in rural areas are likely to be left facing considerable residual risk. This leads households to search for and adopt other, possibly quite costly, strategies to smooth income or consumption. It also creates significant latent demand for financial trade with outsiders. Income smoothing strategies include scattering plots (McCloskey 1976;

Townsend 1993), choosing a lower return but more diversified mix of crops and non-farm production activities, migration and marriage patterns (Rosenzweig and Stark 1998), the adjustment of intertemporal labor supply in response to shocks (Kochar 1999), labor bonding and debt peonage (Srinivasan 1989; Genicot 2002), and many other choices. While some of these strategies might be used alongside financial trade even in a world of complete markets, when financial markets are incomplete the neat separation between household production and consumption choices will be broken, leading individuals to make costly and inefficient adjustments to production and investment plans with obvious welfare consequences.

Research pointing to evidence of such costly strategies is vast, and we will mention only a few prominent examples. Kochar (1999) showed that over three-quarters of the correlation that Townsend (1994) found between household and village aggregate consumption could be accounted for by the households' increased supply of labor to the agricultural wage market following a shock to their farm production. In other words, when hit by an idiosyncratic production shock, households appear to have smoothed consumption by smoothing income rather than via financial transactions as many readers of Townsend's work might have assumed. Adjustments to labor supply plans can of course be highly disruptive, particularly if they disrupt human capital formation projects. Jacoby and Skoufias (1997) is just one of many studies that finds evidence that children in poor households work more and attend school less in response to idiosyncratic income shocks (Beegle, Dehejia, and Gatti 2003; Jensen 2000; Duryea, Lam, and Levison 2003).

To complement the literature that documents the extreme degree of fragmentation in rural financial markets (section 2.1 above), there is some research that attempts to

measure the extent of credit rationing in these imperfect rural financial markets. Many surveys have found that farmers claim that they would borrow more if additional credit were available at a given interest rate (Diagne and Zeller 2001; Zeller, Diagne, and Mataya 1998). However, it is sometimes difficult to interpret these counterfactual responses. Some papers have attempted to use econometric methods to measure the extent of rationing in rural credit markets (Bell, Srinivasan, and Udry 1997; Kochar 1997), but these estimates are based on identification assumptions that must be considered to be tentative. Moving our focus beyond rural finance, Banerjee and Duflo (2004) show that an arguably exogenous increase (followed by a decrease) in the availability of credit to a set of firms who borrow from a particular Indian bank was associated with an increase (followed by a decrease) in output of those firms, providing well-identified evidence of credit constraints.

Amartya Sen (1982) points to the importance of land as an asset for smoothing income when he wrote "a small peasant and a landless laborer may both be poor, but their fortunes are not tied together." He has argued that wage labor markets often collapse rapidly at the outset of a famine and whereas households with land can often fall-back upon this or other assets for subsistence purposes to buffer the shock, wage laborers have few other assets to work with. Land may also 'entitle' the owner to a larger share of the communities' diminished resources than the landless. For example the household with land may be able to borrow in a crisis, whereas the landless or those with low social standing may not.

Households may also try to smooth consumption by accumulating or decumulating physical buffer stocks of assets such as animals, grain, land, or jewelry. When the assets

are used directly in production and there are incomplete or missing rental markets, consumption-smoothing can again come at the cost of productive efficiency. Rosenzweig and Wolpin (1993) document this cost when partial consumption smoothing is achieved by households in the ICRISAT India villages through the sale and purchase of bullocks that are used in production. Kazianga and Udry (2004) provide evidence of a similar cost for households in the Burkina Faso villages surveyed by ICRISAT.

There is a broad consensus of the large empirical literature on risk and household responses to risk in rural areas of LDCs that most households succeed in protecting their consumption from the full consequences of their risky environment. However, they do not do so to the full degree implied by either Pareto efficient risk pooling within specified communities or by strict versions of the permanent income hypothesis.

Imperfect financial markets also shape production organization more generally. It has been clear since the development of the standard agricultural household model (e.g., Singh et al. (1986); de Janvry et al. (1991)) that the organization of production on the household farm depends upon the nature of the financial markets available to the household. The same literature shows that household labor supply response to price changes, for example, depends upon the household's access to financial markets. Eswaran and Kotwal (1986), for instance show how access to capital, which in turn is related to the initial distribution of land, may shape equilibrium patterns of production organization, including whether land is worked by wage laborers or tenants, and the efficiency of production. Carter and Zimmerman (2000) analyze a dynamic version of this model.

More generally, the structure of rural economic relations itself depends upon the nature of available financial contracts, which in turn of course depend upon the structure of rural economic activity. This joint causation opens up the possibility of a wide range of potential equilibria, and an important research agenda.

A series of important papers have examined the role of financial market imperfections in generating a persistent non-degenerate income distribution (Loury (1981) is an early paper that raises this issue). Galor and Zeira (1993) and Banerjee and Newman (1993) show in an economy characterized by non-convexities in investment, capital-market imperfections can cause initial disparities in wealth to persist across generations. Moreover, the distribution of wealth affects aggregate patterns of economic activity and growth, decisively breaking down any potential separation between "efficiency" and "equity" in the analysis of economic policy.

There has been a flowering of related theoretical work on linkages between distribution and growth when financial markets are imperfect. Mookherjee and Ray (2003) and Matsuyama (2002) are also good points of entry into this literature.

More recently, there have been some attempts to link these theoretical insights to data. Banerjee and Duflo (2004) examines an array of reduced-form implications of these theories, with special emphasis on data from India. There is a rapidly growing literature that examines the empirical implications of models of the endogenous growth of financial intermediation in the context of dynamic general equilibrium models with heterogeneous agents. The most recent important papers include Jeong and Townsend (2003), who examine the microeconomic underpinnings of growth models with imperfect capital markets using data from the repeated cross-sections provided by the Thai Socio-

Economic Surveys. Felkner and Townsend (2004) undertake an exercise with a similar objective, but instead using a repeated census of villages in Thailand, and with a strong emphasis on spatial relationships that are generally ignored in the theoretical literature.

3.4 Contracting under asymmetric information and imperfect enforcement

These observations lead to several obvious questions: Why do financial markets and risk sharing arrangements often fail to achieve efficient exchange even in small village communities? What explains the structure and organization of actual financial markets? Why are diversified outside financial intermediaries such as banks and insurance companies often reluctant or slow to enter rural financial markets?

The defining characteristic of all financial contracts is that they involve the exchange of state-contingent promises or IOUs. But the fear that promises may be broken can limit the set of credible promises that a would-be issuer can commit to keeping. In a world of complete markets this problem was abstracted away by simply assuming that all potential contract breaches could be immediately detected and costlessly deterred, but most of the modern literature on financial contracting focuses on how asymmetric information and limited enforcement problems may together limit the set of feasible commitments. This theory has proven powerful and rich at providing insights with which to interpret the shape of real world financial contracts and institutional arrangements.

While the theoretical literature on asymmetric information and imperfect enforcement is rich, there has been comparatively little empirical work that attempts to characterize the exact nature and extent of imperfect information in rural financial markets. Chiappori (forthcoming) is a useful review of relevant literature in the developed country context. Aleem (1990) provides dramatic direct evidence of the

importance of screening costs for lenders. Klonner (2004) shows that asymmetric information has dramatic consequences for bidding patterns in (high-value) ROSCA auctions in a village in Southern India. Gine and Klonner (2003) examine the role of imperfect information regarding borrower type for the structure of financial markets in a coastal village in Tamil Nadu. They show that uncertainty about (fishing) entrepreneurs' ability slows the pace of costly technological innovation for relatively poor entrepreneurs. Karlan and Zinman (2004) use a randomized intervention to identify the extent of adverse selection and moral hazard in a South African credit market. They find that about 40% of defaults in this market can be attributed to one of these types of asymmetric information.

Asymmetric information makes it difficult for a would-be creditor or insurer to be sure whether the expected probability distribution over state-contingent payoffs associated with a contract promise is the one being represented by the seller or not, as in the case of adverse selection (private information about the agent or the project's characteristics) or moral hazard (private information about whether a specified action or contingency has occurred or not). In practice variants of each of these problems may be the concern.

A farmer may promise to work diligently to repay a loan but when that farmer's harvest fails and he declares a default a lender may not be able to tell whether this was due just to bad luck or to the farmer's mishandling of the loan. Lenders and insurers may also not be able to very easily verify whether the farmer's reported harvest failure is genuine or mis-represented. In each of these cases the problem turns around to bite the borrower or the insuree who will have a hard time obtaining credit or insurance from any source in the first place unless they find a way of credibly signaling their commitment.

Problems of commitment can also arise however even when information is perfect and symmetric because even though actions and outcomes are observed agents may still be able to simply renege or walk away from their commitments unless they face credible and effective sanctions to dissuade such opportunistic default. Some literature refers to this last problem of opportunistic default as the problem of 'limited commitment' (e.g. Ligon, Thomas, and Worall 1999; Paulson and Townsend 2003) yet many contracting problems involve an agent's limited ability to commit to fulfilling elements of a contract, whether it be to truthfully reveal their type (adverse selection), to take a specified action (ex-ante moral hazard), to truthfully report an outcome (ex-post moral hazard), or to deliver on a promise (opportunistic default).

Each of these problems is related and are all believed to play important roles in shaping the pattern of financial contracting everywhere. A very large literature now exists that has studied these problems (textbook treatments include Laffont and Martimort 2003; Macho-Stadler and Perez-Castrillo 2001; Salanié 1997) and the manner in which each of these problems separately contributes to shaping the set of feasible financial contracts in exclusive bilateral exchanges is by now quite well understood. There is still much new research however left when it comes to trying to understand what shapes the equilibrium pattern of financial contracting for interactions between individuals and sub-coalitions within and across larger groups.

Since this literature is vast our focus will be of necessity selective. Although we will touch briefly on the problems of adverse selection and opportunistic default along the way, we shall organize a good deal of the discussion of some of the more complicated issues of multi-agent interaction around a set of variants of a simple model moral hazard.

Since in all cases the problem is one of limited commitment, each of these other contracting problems will tend to invoke similar concerns and will often be addressed with related contractual solutions (e.g. the use of collateral, monitoring, multi-period contracting, 'interlinking', etc). Even with this simple model a rich picture emerges of the structure and operation of rural credit and insurance markets, the role of financial intermediaries and the challenges they face in operating in rural areas, as well as the role of government and public policy.

3.5 Moral Hazard

Stiglitz (1974) laid out one of the earliest modern treatments of moral hazard in an important paper that sought to explain the age-old question of why in some contexts sharecrop contracts might dominate fixed-rent tenancy contracts. Key assumptions driving Stiglitz' analysis are that a tenant/worker's effort choices, which affected the distribution of project outcomes, are costly and cannot be observed by the landlord, and therefore could not be specified directly in a contract. If the worker was offered either a full insurance (fixed-wage) or partial insurance (sharecrop) contract the worker had an obvious incentive to choose a lower effort level (while claiming otherwise) since he then avoided effort disutility without having to bear the full consequence of that lowered effort on expected output. Classical economists from Adam Smith to Alfred Marshall had puzzled over why such seemingly inefficient contracts persisted in practice.

In the case of a risk-neutral agent, the well-understood contract to avoid this moral hazard or 'Marshallian inefficiency' problem was to offer the tenant a fixed rent (or fixed debt) contract of the form $c_{js} = x_{js} - R$ to make him a full residual claimant. This made the agent bear the full marginal benefit and the full marginal cost of his effort choices and

hence aligned the agent's incentives with those of the creditor/landlord. What Stiglitz pointed out however was that if the farmer was risk-averse this solution imposed too much risk on the agent to be optimal. A tradeoff existed between providing incentives and sharing risks and Stiglitz argued that a sharecrop contract might strike the right balance between the two.

It is useful to briefly review the key elements of this well-studied model but recasting it using a parameterized distribution approach to permit more flexible sharing rules than Stiglitz' original linear contract assumption. A single agent now contracts exclusively with another villager or financial institution (FI) that is assumed to be large and diversified enough to be modeled as a risk-neutral Principal. Farm projects require an investment *I* and the agent can take one of two possible effort choices: either 'high' effort (e^H) or 'low' effort (e^L), such that $V(e^H) > V(e^L)$ where *V* measures the agent's disutility of effort. To simplify further *I* is a fixed lump sum amount and we assume the villager must borrow this entire amount. Higher effort choice leads to a higher expected project return,[4] and we assume $E[x_{js} \mid e^H] > E[x_{js} \mid e^L]$ where $E[x_{js} \mid e] = \sum x_{js}\pi_{js}(e)$.

On a competitive financial market, FI's would compete to offer exclusive loans of size *I* and each villager would end up choosing their most preferred feasible contract amongst these offers. The optimal contract therefore maximizes expected borrower utility subject to the constraints of providing clear incentives for the agent to commit to high effort and to make expected repayments sufficient to cover the lender's opportunity cost of funds:

[4] For the moment the event space *S* is assumed to consist simply of the set of possible outcomes on the farmer's project at each level of *e* and *I*. This will later be relaxed.

$$\max_{c_{js}} Eu[c_{js} \mid e^H] - V(e^H) \tag{1.4}$$

$$E[(x_{js} - c_{js}) \mid e^H] \geq I(1+r) \tag{1.5}$$

$$Eu[c_{js} \mid e^H] - V(e^H) \geq Eu[c_{js} \mid e^L] - V(e^L) \tag{1.6}$$

where (1.5) is the lender's break-even or participation constraint requiring that expected repayments at least cover the opportunity cost of funds[5], and (1.6) is the borrower's incentive compatibility (IC) constraint requiring that the borrower expect to earn more under the contract when they choose high effort. The optimal sharing rule c_{js} is characterized by the following well-known first order conditions, one for each state:

$$\frac{1}{u'(c_{js})} = \lambda + \mu \left[1 - \frac{\pi_{js}(e^L)}{\pi_{js}(e^H)} \right] \tag{1.7}$$

where λ and μ are, respectively, the Lagrange multipliers on the lender's participation constraint and the borrowers incentive constraint. When the agent's effort choice is verifiable the IC constraint would not bind ($\mu = 0$) and the efficient contract will equalize the farmer's marginal utility of consumption across all states, $u'(c_{js}) = 1/\lambda$ which requires guaranteeing the farmer a constant level of consumption $c_i = \bar{c}$ in every state. This is just an adaptation of the earlier conditions (1.3) to the case of a risk neutral FI. One interpretation is that the farmer 'sells the farm' and uses the proceeds to finance current investment *I* and obtain income to guarantee fixed consumption in the following period. In Stiglitz' analysis the risk-neutral landlord owned the project and hired a fixed wage laborer (in that context $I > 0$ could be interpreted as a wage advance).

When effort is not contractible and the IC binds, full insurance will not be possible. The agent's consumption in each state must now be tied to the inverse likelihood

[5] One could also interpret a contract with $I \leq 0$ as having the farmer making a first period payment to purchase second period insurance.

ratio $\pi_{js}(e^L)/\pi_{js}(e^H)$ in expression (1.7). The optimal sharing rule attempts to reward those outcomes that have the highest likelihood ratios – i.e. those most likely to have resulted when the agent chooses the effort level the contract wants to implement rather than a lower effort level -- and punish those outcomes with low likelihood ratios, all tempered by the competing objective of not imposing too much costly risk on the agent. Unfortunately, one of the few clear results to emerge from this literature is that the optimal sharing c_{js} will in general be non-linear and strongly influenced by the underlying characteristics of distribution $\pi(s,e)$ and how it responds to changes in effort (Grossman and Hart 1983). Deriving even the simple property of monotonicity – that the farmer's return be non-decreasing with the size of the project outcome x_{js} – requires making rather strong distributional assumptions. Specifically it requires assuming a monotone likelihood ratio property (MLRP) that the expression in brackets on the right hand side of (1.7) be monotonically non-decreasing in output x_{js}. Intuitively, higher output levels must provide stronger signals that the agent chose a higher effort.

The prediction that contracts should be highly state-contingent has led some observers to point out somewhat of an empirical puzzle. Theory predicts non-linear and highly state-contingent optimal sharing rules that they claim do not seem much like the simple linear sharing rules (e.g. linear sharecrops or fixed debt contracts) often described in rural contexts (Allen and Lueck 2002). There have been different responses to this challenge. One approach has been to point to other constraints and trading frictions, for example problems of state verification (Townsend 1979), limited liability (Innes 1993) and/or contract renegotiation (Matthews 2001) place additional restrictions on the range

of feasible contracts and this might help explain these simpler contract forms. Another response has been to argue that real world contracts are in fact far more state-contingent than what first meets the eye (Townsend 2003). For example, it is not uncommon for a lender to allow a borrower to miss a couple payments, or even to forgive a portion of the loan if the borrower has fallen on bad luck. This idea has been also explored extensively in the literature on multiperiod contracting and sovereign debt lending (Grossman and Van Huyck 1988). Once one takes such excusable defaults into account, contracts start to look far more state contingent, and more like theory predicts. Udry (1994) provides empirical evidence documenting a high incidence of excusable state-contingent default in rural loans in Nigeria.

Another important property of the optimal contract that explains important features of many agricultural contracts is Holmstrom's (1979) sufficient statistic result that demonstrates that optimal sharing rules should be tied not only to the outcome of the farmer's own project but also to any other signal from the environment that helps the principal draw a sharper inference about the agent's choices. For example, a lender ought to be more willing to rollover a debt following a bad harvest outcome on a farmer's project if other farmers in the area also had low harvests, but less willing if other farmers had good harvests. The purpose is to better filter signals so as to attempt to reward or punish borrowers' only for those outcomes over which they exert some control and insure them against those over which they do not. The result will be more cost-effective incentives and better insurance. This logic of tying contract terms to other verifiable signal that leads to sharper inferences has been evident in the design and regulation of agricultural contracts for centuries as is evident for example from Hammurabi's code

(circa 1795 BC) which stated that "If any one owe a debt for a loan, and a storm prostrates the grain, or the harvest fail, or the grain does not grow for lack of water; in that year he need not give his creditor any grain, he washes his debt-tablet in water and pays no rent for this year."

Relative-performance evaluation (RPE) contracts, which make one farmer's reward a non-increasing function of observed outcomes on other agent's projects, build on this insight (Mookherjee 1984). There is convincing evidence to suggest that RPE contracts are ubiquitous and play an important role in many types of agricultural labor and financial contracts. For example, RPE contracts that tie a farmer's returns to industry averages of yield or quantity are commonly used in livestock raising and agroindustry commodities (Knoeber and Thurman 1994). Hueth and Ligon (2001) argue that relative performance incentives are also built into many other types of contracts via payment mechanisms that depend on market prices.

The analysis so far has implicitly assumed that a) the agent contracts exclusively with one principal, b) project outcomes can be observed and costlessly verified and output-contingent commitments can be costlessly enforced. The next sections discuss the consequence of relaxing both assumptions and extends the analysis to multi-period contracting.

3.6 Multi-period and Repeated Contracts, Limited Commitment, and Reputation

Lambert (1983) and others have shown how the basic one period moral hazard problem can be extended into a multi-period environment with commitment. When either or both parties can commit to a multi-period sharing rule there is scope for improvement over the one-shot contract. The optimal multi-period optimal sharing rule

can be interpreted as a sort of ‘reputation’ updating mechanism in which the amount of state-contingent default (insurance) that a creditor is willing to provide a borrower following a bad realization in any given period is made to depend in part on that borrower’s past history of realizations. Contracts will have ‘memory’ in the sense that agents who had good (bad) realizations in the recent past will be rewarded (punished) by raising (lowering) the return they can expect following any future realization. A good reputation is like an earned privilege that provides the agent with access to future surplus. The prospect of earning, or the fear of losing, this privilege can act as an effective incentive to economize on present period incentives. The ability of the principal to commit to delivering rewards for current or past good behavior allows for the provision of both better incentives and more insurance over the life of the contract compared to a series of one period.

The longer such an agency relationship can be expected to last the more the incentive problem can be alleviated. These findings are consistent with intuition and with empirical studies such as Sadoulet et al (1997) who found that landlords in the Philippines who contracted with tenants with whom they shared kin relationships (which amongst other things could proxy for the length of the expected relationship) were more likely to offer insurance within multi-period tenancy contracts.

These results depend crucially however on the assumption that each party can commit to not renegotiate or abandon their exclusive multi-period commitments. Ex-ante efficient choices are sustained by the ability of both parties to commit to not renegotiate ex-post inefficient outcomes. Without an ability to make such commitments, finite multi-

period contracts cannot improve on a series of one-period contracts (Fellingham et al (1985)).

Commitments of any sort are often difficult to enforce via third parties or the courts. If third party enforcement is not possible, then contract obligations need to be *self-enforcing* – they need to be sustained via incentives built directly into the contract. The simple moral hazard problem illustrates how a commitment to implement a particular effort level might be sustained via incentives fashioned out of the verifiable output-contingent commitments that the principal and agent are assumed to be able to enforce directly. But sometimes even output-contingent promises will be difficult to sustain. For example, a farmer might try to hide or under-report the true outcome on his project or, even if the farmer's project could be perfectly observed, he may simply choose to default on his repayment obligation.

A large literature has studied conditions for the emergence of self-enforcing lending and mutual insurance arrangements in the context of infinitely repeated non-cooperative games. In the simplest setting a farmer wants to obtain a loan of fixed size *I*. A lender will only participate if she can expect to be repaid $I(1+r)$. The loan funds a project with certain outcome $x \geq I(1+r)$. Financing would be efficient except that in the absence of any exogenously enforced social sanction the farmer's dominant strategy in a one-shot interaction is to take the loan and then default. Anticipating this, the lender's dominant strategy is not to lend in the first place. If, however, the interaction is repeated over an indefinite horizon it may be possible to generate incentives for the farmer to continue to repay if the threat of loan non-renewal is credible and sufficiently punishing. Suppose the farmer has a time separable utility function with discount factor δ, that he gets zero

utility in each period that he fails to get a loan, $y = x - I(1+r)$ in the periods he repays, and x in he defaults. Cooperation (repayment in every period) can then be sustained as a subgame perfect Nash equilibrium (SPNE) so long as the following incentive constraint is met in every period:

$$\frac{u(y)}{(1-\delta)} \geq u(x)$$

Cooperation is more likely to be sustained the more the borrower values the future and the lower the size of the expected repayment $I(1+r)$ relative to x. The lender's threat of cutting off the borrower from future access is viewed as credible because this 'grim strategy' is itself a subgame-perfect equilibrium.

Notice again the importance of the implicit assumption that the borrower and the lender have an exclusive relationship. A problem arises if the lender cannot commit himself not to renegotiate after a default has occurred. If the lender could potentially make a profit by lending again to the borrower who has defaulted, then perhaps the 'grim strategy' punishment could be renegotiated in such a way that, ex-post, both parties are better off. Of course, this very possibility could restrict the penalties that can be sustained in equilibrium leading to the collapse of financial trade. We will shortly return to the issue of renegotiation.

A similar problem arises if the borrower and lender do not have an exclusive relationship. If a new potential lender were suddenly to appear on the scene, the above relationship could be undermined by the fact default may now be a less severe punishment because a borrower who defaults on one lender may now start up a relationship with a new one. Of course the second lender will face the same problem as

the first, so ironically, the mere presence of a competitor – the inability to commit to exclusive arrangements – can lead to the complete collapse of financial trade.

Lending could be restored if lenders could share default information and agree to collectively punish a defaulter. But this presupposes that others will punish a lender who does not herself punish the defaulter. In societies that have well functioning publicly funded court systems such exclusivity arrangements can often be exogenously enforced, for example by allowing existing creditors to establish liens over a farmer's future harvest or existing property. Such institutions however do not exist or work properly in many contexts. In such cases 'community punishment' arrangements have to themselves also be self-policing. Kandori (1992) pioneered the analysis of equilibria in which defection by one agent leads to sanctions by others and in which the "social norm" to punish is itself sustained via self-interested interactions. The analysis points to the likely emergence of public institutions for information dissemination such as labels that indicate reputation, membership, or license, which are revised systematically. Greif (1993) is an early example of the usefulness of this reasoning for understanding enforcement mechanisms in trade relations. La Ferrara (2003) adapted this sort of framework to conduct an interesting theoretical and empirical analysis of community enforcement across generations within kin groups in rural Ghana.

Kimball (1988), Foster (1988) and Coate and Ravallion (1993) extended the study of self-enforcing (exclusive) mutual insurance arrangements in agricultural economies when farmers operate risky projects. These showed how closely mutual insurance 'cooperatives' of different numbers of borrowers could get to the efficient risk sharing condition (1.3) depended on how heavily farmers discounted the future, the nature of

their risk aversion, and the variance of underlying project returns. Using simulations, Kimball demonstrated that it was easier to sustain mutual insurance arrangements with a larger number of farmers but harder to enforce full risk sharing in a larger group. Coate and Ravallion demonstrated that under reasonable assumptions the extent to which such arrangements diverged from efficient risk sharing decreased as mean incomes rose, increased as incomes became more covariate, and increased with the inequality amongst members. One of the results to emerge from this literature is the rather high sensitivity of the performance of these arrangements to small perturbations in parameter values, for example to small changes in risk aversion, suggesting 'wildly divergent performances of the moral economy (Coate and Ravallion 1993 /, p.19).'

The problem of sustaining self-enforcing financial contracts when agents cannot make binding commitments not to renegotiate terms ex-post has received a good deal of recent attention. An important contribution of Coate and Ravallion (1993) was their characterization of a renegotiation-proof mutual insurance equilibrium for two households in a risky environment. They restricted attention to stationary transfers. Kocherlakota (1996), Ligon, Thomas and Worrall (2002), and Genicot and Ray (2002) amongst others have made important extensions of this work to dynamic contracts and to many agents. The term 'quasi-credit' is often used to describe the arrangements that emerge because they can be interpreted as informal loans with implicit repayment made contingent on the lender's needs and the borrower's ability to repay (Fafchamps (1999; 2004)).

Ligon et al. (2002) provide an explicit characterization of such reciprocal transfer arrangements in an economy that allowed for both idiosyncratic shocks and common

shocks that could be correlated over time. We showed in equation (1.3) that when the agents can commit to mutual insurance, the Pareto efficient allocation fixes the ratio of marginal utilities between any two agents. Ligon et al. show that the constrained-efficient allocation in a limited commitment environment involves intervals of the ratio of marginal utilities. For any given state of nature (which describes the incomes received by any two households *i* and *j*), there is an interval of the ratio of marginal utilities that can be supported in the renegotiation-proof equilibrium. The endpoints of this interval are determined by the size of the transfer that can be supported in the equilibrium: if too large a transfer were required from *i* to *j*, *i* would not find it in her interest to continue participating in the mutual insurance arrangement. If last period's ratio of marginal utilities falls within that interval, then the ratio remains constant. For those two periods, at least, the allocation looks just like the full commitment equilibrium described in (1.3). However, if last period's ratio of marginal utilities falls outside the interval, than it can no longer be supported in equilibrium. The ratio of marginal utilities in this period will instead be at the endpoint of the interval of ratios that can be supported, and the party that is transferring resources to the other is just indifferent between continuing the arrangement and defaulting. Ligon et al. test the dynamic limited commitment model against the alternatives of full insurance (and against a static limited commitment model similar to that of Coate and Ravallion (1993)) using the same dataset that Townsend (1994) had used to test risk pooling in Indian villages. They find evidence that the dynamic limited commitment model fits the data better than either alternatives.

Several of these ideas have also been explored rather extensively in the literature on sovereign debt lending (Grossman and Van Huyck 1988; Kletzer and Wright 2000).

These sorts of frameworks have also been applied to games with repeated moral hazard, or as the literature calls them, games with imperfect monitoring (Abreu, Pearce, and Stacchetti 1990), where contract terms must now be chosen to also motivate hidden actions. Paulson and Townsend (2003) have tested between models of 'limited commitment' and moral hazard using data from a survey of rural and semi-rural households in Thailand. They find evidence that both types of imperfection matter but that 'limited commitment' concerns are more dominant for poorer households while moral hazard becomes more important as household wealth increases.

There is also a set of less formal observations regarding patterns of mutual insurance in rural areas of developing countries that point to the likely importance of imperfect enforcement, asymmetric information and limited commitment. Prime among these is the observation that mutual insurance tends to be most effective within relatively narrowly-defined groups. Lund and Fafchamps (2003) provide evidence that mutual insurance among rice farmers in the Philippines flows through social networks of friends and family. Murgai et al. (2000) show that irrigation water insurance in Pakistan is highly localized among clusters of close friends and family. If random shocks tend to be correlated among these kinds of social groups, any restriction of mutual insurance to such groups is costly in terms of the value of the insurance thereby provided. The relative ease of observing the realizations of random shocks, or of enforcing agreements within narrowly-defined social groups is probably the most important reason for this observation. Genicot and Ray (2002) provide a useful formal treatment of the endogenous formation of mutual insurance groups.

3.7 Limited Liability, Collateral and its Substitutes

A striking empirical fact about the operation of rural financial markets that has already been mentioned is how markedly the conditions of access can vary across households and how closely financing terms are tied to production activities. It is not uncommon to encounter situations where some farmers in a given region finance the bulk of their crop activities with commercial bank loans while smaller nearby farmers growing the same crops only finance with retained earnings or via more expensive informal moneylenders. It is also not uncommon to observe farmers who can obtain very generous financing from product traders or contract farming firms for certain crops, but almost no financing at all for other profitable crop activities grown in the same area but marketed through different channels.

If markets where complete all socially profitable investment projects would be financed regardless of the initial asset holdings of the borrower or the type of crop activity. In practice however the terms of loan access tend to be frequently tied to the borrower's existing asset position and production mix because agricultural lenders ask for land or chattel property mortgage pledges or other guarantees. Even when no such formal pledges are made lenders may simply prefer to deal with farmers with proven assets and/or more diversified cash flows. When this is the case the initial distribution of assets can have important effects on the structure and performance of the real economy and the number and types of financial contracts and intermediaries that can emerge. To build a theory of these issues one has to understand the role of limited liability and collateral.

Consider again the simple one period moral hazard problem but suppose now that the farmer is risk-neutral. Since there is no longer a tradeoff between insurance and

incentives, the first-best solution is to make the agent a full residual claimant. A fixed debt contract (FDC) that obliges the borrower to repay $I(1+r)$ regardless of the project outcome offers such a solution, leaving $c_{js} = x_{js} - I(1+r)$ to the agent. This will not be feasible however if the agent is unable or unwilling to make the full required fixed repayment $I(1+r)$ in some low outcome states. This would happen for example if project returns x_{js} plus all of the borrower's additional (or 'collateral') cashflows and liquid property assets are simply not sufficient to cover the fixed repayment amount. To remain feasible contracts must therefore satisfy limited liability constraints of the form $R_{js} \leq x_{js} + A_{js}$ for all s where A_{js} is the maximum value of collateral resources a farmer can credibly pledge to transfer to the creditor in state s.

In a seminal paper Stiglitz and Weiss (1981) studied the impact of adding such constraints on the shape of feasible equilibrium contracts. By placing an upper bound on an agent's exposure to consequences when projects fail, limited liability may end up encouraging agents to choose excessively risky (i.e. low effort) projects. In such circumstances, rather than help compensate for expected losses, increasing the loan interest rate may only aggravate the problem by reducing the agent's marginal reward to choosing higher effort. Stiglitz and Weiss showed that this may (but need not always) lead to a backward bending supply curve and equilibrium credit rationing. Banerjee (2003) discusses how this kind of mechanism can result in a 'multiplier' effect: relatively small changes in the economic environment (such as the opportunity cost of capital to lenders) can induce large changes in equilibrium contract terms. As interest rates rise, the pool of borrowers becomes more and more risky, leading to a quickly rising interest rate and the potential collapse of the market.

Stiglitz and Weiss presented their results using the state-space approach and assumed piece-wise linear Standard Debt Contract (SDC) of the form $R_{js} = \min(x_{js} + A, R)$ where the creditor receives fixed loan repayment *R* or seizes all of the borrower's project returns $x_{js} + A$ plus available collateral, whichever is smaller. This can be interpreted as a fixed debt contract with excusable partial default for all harvest outcomes below a certain level. Innes (1990 Proposition 2) worked out the analysis using the parameterized distribution approach and demonstrated, somewhat strikingly, that when limited liability constraints bind the optimal contract for a risk neutral agent is *not* a debt contract but rather an extremely fine-tuned live-or-die contract (LDC) that lumps all of the agent's reward on the one project outcome with the highest likelihood ratio and punishes them up to limited liability constraint in all other states. Innes also demonstrated however that a more familiar Standard Debt Contract (SDC) form become optimal once a few reasonable additional assumptions are imposed. These are that feasible contracts also monotonicity constraints requiring that repayment levels are non-decreasing in the size of the measured project outcome (i.e $R_{js} \geq R_{js'}$ for all $x_{js} \geq x_{js'}$) as well as the earlier mentioned MLRP condition. Monotonicity constraints can be justified as necessary to remove incentives for lenders to opportunistically sabotage or mis-measure farmer's project outcomes and/or to prevent farmers from side-contracting with other farmers to artificially raise measured project outcomes in ways that could harm the lender's interests. Since measurement disputes between farmers and traders are frequent in practice, the assumptions are not unreasonable.

The point of dwelling on this seemingly technical detail is to point to the potential pitfalls of analyses that simply *assume* rather than derive linear contracts forms. While

Stiglitz and Weiss were prescient enough to assume a piece-wise linear standard debt contract form (which is enough to lead to the optimal SDC form) other researchers have sometimes proposed linear contract solutions that on later examination were shown to be sub-optimal in a more general environment. For example, some papers have argued that limited liability provides an alternative explanation for the existence and prevalence of share-tenancy arrangements even in the case of risk-neutral agents (Shetty 1988; Basu 1992). The argument was that tenants with insufficient collateral to be able to meet fixed rent obligations to a landlord or creditor in low outcome states would be more likely to seek and obtain share contracts rather than fixed rent/debt contracts. This they argued might provide micro-foundations for Spillman's (1919) tenancy ladder hypothesis which saw younger, less well capitalized farmers entering into sharecrops before later graduating to fixed-rentals and eventually farming their own land as they accumulated wealth and experience. Spillman's hypothesis may well be true, but a sharecrop is always dominated by a SDC-style fixed rent contract with excusable partial default for low harvest realizations for risk-neutral limited liability constrained tenants because an SDC provides more high-powered incentives in those states where limited liability does not bind (see Ray and Singh (2001) for a related discussion).

Adding risk-aversion back into the analysis makes the optimal contract again considerably more state-contingent. It turns out to be difficult to derive many general characterizations regarding how optimal contract terms vary across risk-averse agents of different wealth and risk-tolerance levels because of potential counter-posed effects. Standard risk-sharing analysis suggests that the risk premium that must be paid declines with an agent's wealth under the common assumption of decreasing absolute risk

aversion (DARA). At the same time, however, agents become less sensitive to a given difference in payoffs across states as wealth increases and this last effect makes it more costly to provide incentives in a moral hazard setting (Thiele and Wambach 1999). The relation between agent wealth and the cost of contracting can therefore in general be non-monotonic. Hence it is possible that a landlord would prefer to lease a plot of land to a poor tenant rather than to a medium-poor one, but would prefer an even wealthier tenant to either of the others. If we now add binding limited liability constraints to the problem the same landlord may switch to instead now preferring the medium poor tenant to the poor one. Boucher and Carter (2002) and Boucher and Guirkinger (2004) discuss some of these issues and apply the theory to explain how observable patterns of production specialization and credit and insurance contract choices in a rural setting change with borrower wealth. See also Mookherjee (1997) and Madajewicz (2004) for related work.

Partly because of such complications, most models of financial intermediation study limited liability with risk-neutral agents. To streamline the survey that follows let's simplify the model further by assuming just two project outcomes and two effort levels. The crop harvest is now the outcome of a Bernoulli trial. If the borrower is diligent the harvest succeeds and yields x_1 with probability p or fails and yields x_0 with probability (1-p). If instead the farmer is non-diligent (chooses low effort), the probability of a good outcome falls to $q < p$. If we also define $B = V(e^H) - V(e^L)$ to denote the opportunity cost of high effort, the incentive constraint (1.6) can now be written as

$$pc_1 + (1-p)c_0 \geq qc_1 + (1-q)c_0 + B,$$

or re-arranging:

$$c_1 \geq c_0 + \frac{B}{(p-q)}. \tag{1.8}$$

A borrower's consumption following a good outcome has to be made sufficiently larger than consumption following a bad outcome to generate incentives for the borrower to want to raise the probability of success by choosing diligence. Since the limited liability constraint, $c_0 \geq -A$, restricts how much the borrower can be punished for a project failure, the incentive constraint (1.6) can only be met by setting the borrower's good outcome consumption level to at least $c_1 = c_0 + B/(p-q)$. Since limited liability curbs the size of the borrower's assets that can be seized following bad outcomes, the incentive to be diligent must now be created by offering a costly incentive 'bonus' in the good state (in credit contract terms the interest rate must be lowered in non-default states).

Hence, if the limited liability constraint is binding, $c_0 = -A$, then the incentive compatibility constraint implies that a borrower with assets A must earn a minimum expected return of at least

$$E[c_s \mid e^H] = \frac{pB}{(p-q)} - A \tag{1.9}$$

if incentives are to be maintained.

If we normalize the farmer's reservation payoff (what they could earn elsewhere by not accepting the contract) to zero then expression (1.9) can be interpreted as the size of the limited liability rent needed to keep incentives in place. It measures the necessary minimum expected payment over and above the agent's (zero) reservation return that is needed to keep the borrower diligent. Substituting this into the lender's participation constraint (1.5) gives

$$E[x_s \mid e^H] - \left[\frac{pB}{(p-q)} - A\right] \geq I(1+r) \tag{1.10}$$

From which it is clear that the lender will only willingly participate and finance a borrower if the limited liability rent (1.9) does not become too large, since otherwise too little of expected project returns $E[x \mid e^H]$ will be left over to cover the lender's cost of funds $I(1+r)$. One way to assure a lender that this will not be the case is to insist that all borrowers post collateral A in excess of a minimum *collateral requirement*

$$\underline{A} = \frac{pB}{(p-q)} - [E[x \mid e^H] - I(1+r)] \tag{1.11}$$

which is the level of A that is just sufficient to make (1.10) bind exactly. If lenders compete for a borrower's business but only participate on profitable loans, then an optimal contract will have the borrower retaining $s_f = -\underline{A}$ when the project fails and $s_s = -\underline{A} + B/(p-q)$ following success.[6] The minimum collateral requirement grows with the size of the loan or the lender's cost of funds r and with the borrower's opportunity cost of diligence B. The collateral requirement will be smaller the larger is the expected project return under diligence and the 'safer' is the project under diligence compared to non-diligence (the larger is p relative to q). This last result suggests reasons why lenders may want to steer collateral-poor borrowers toward safer, but possibly lower return projects.

The practical problem with this method to obtain a borrower's commitment to diligence is that it may exclude a large number of borrowers with good projects but insufficient collateral. A good part of the vast literature on financial contracting and financial intermediation since Stiglitz and Weiss (1981), and arguably also a significant

[6] Innes (1990) shows how to generalize the analysis to contracts with multiple outcomes and effort levels.

part of real-world financial innovation, can be understood as efforts to find new mechanisms to create collateral substitutes or, in slightly more technical terms, ways to relax incentive constraints so as to reduce the size of the limited liability rents that limit the range of feasible contracting. One prominent strategy is for the lender to use intermediaries or delegated monitors who can help reduce information asymmetries or engage in 'monitoring' and 'control' activities aimed at directly lowering the agent's return from moral hazard. Other methods include 'incentive diversification' strategies aimed at expanding the range of feasible punishments and rewards that can be brought to bear to sustain commitments at lower cost. The latter include contingent-renewal strategies such as the ones already discussed in the context of repeated games, as well as interlinked contracts and group loans.

3.8 Property rights and credit supply

An important reason that limited liability may be such an impediment to contracting is that in many societies property rights are ill defined or contested (Deininger 2003). In a bestselling book, Hernando de Soto (2000) argues that hundreds of millions of poor people in developing countries have de facto possession and local community recognition of property rights over housing, land and other sorts of assets which can be valued in hundreds of billions of dollars worldwide. Yet their lack of formal title limits their ability to leverage those assets on capital markets. Poor people's assets remain 'dead capital' terms, leaving them excluded from the opportunities and benefits that closer integration into competitive capital and product markets might provide. Over the past decade or so, and partly in response to this rallying cry as well as to the falling cost of new mapping and information technologies, governments and international organizations have

promoted vast new property titling programs in almost every country of Latin America and many other countries around the world, just as they have also liberalized financial markets and lifted most of the worst forms of financial repression.

Although increased property rights security has been hypothesized to lead to significant increased investment demand and credit supply responses, the empirical evidence of such effects remains surprisingly mixed. Feder and Feeny (1991) and Siamwalla (1990) present evidence of strong credit supply effects of land titling in several provinces of Thailand. On the other hand studies done for India (Pender and Kerr 1999), Paraguay (Carter and Olinto 2003), Kenya (Carter, Wiebe, and Blarel 1994; Place and Migot-Adholla) and Burkina Faso (Brasselle, Gaspart, and Platteau 2002) all found muted or insignificant effects of tenure security on either investment demand or credit supply. Some of these studies found that investment and credit supply effects, that at first appear positive and significant in simple reduced form regression equations, disappear once more careful attempts are made to control for property rights endogeneity are implemented. The issue is that title status might be influenced by farmers' investments as well as vice-versa. In their study of property rights titling on Paraguayan frontier lands, Carter and Olinto (2003) found strong evidence of a wealth bias: measured credit supply effects were significant but only for farmers above a certain wealth threshold. Possible explanations for the surprisingly muted credit supply responses found in many studies include that (a) formal credit and land sale markets may have still been thin or ill developed in the study areas due to lack of profitable opportunities, (b) land foreclosure remained legally difficult or costly even after reforms, (c) informal property rights systems already provided a good measure of security (particularly in some African

regions) so the incremental effect of legal titling was small. A recent study by Field (2004) finds more marked supply responses to titling programs in an urban setting in Peru, where titling appeared to increase loan approval rates from public (but not private) lenders and, conditional on loan approval, reduced the borrower's cost of funds by an average of 9 percent.

The issue of legal impediments to land mortgages is complicated by the fact that restrictions on the alienability of land have often been imposed via the political process, often with the ostensible aim of protecting farmers from losing land foreclosures to moneylenders. For example, following riots by farmers in the Deccan region of India in 1875, the British colonial authorities passed new laws to protect farmers against land foreclosures by non-farming moneylenders and, a few years later, legislation to promote agricultural credit cooperatives (Darling 1925; Kranton and Swamy 1999).

4 Rural financial intermediaries

Rural households and farm enterprises in developing countries obtain credit and insurance from a wide array of financial service providers including product traders, banks, cooperatives and mutuals, contract farming firms, and input suppliers, and they might also borrow informally from relatives, friends, landlords, shopkeepers or moneylenders. A defining characteristic of many of these financial transactions is that they involve 'active monitoring '(Tirole forthcoming). The aim is to keep agents focused on their efforts to improve the chances that their financed projects do not fail and/or to reduce the possibility that project cash flows may be diverted to other purposes rather than meeting promised repayments. Monitoring is used both as a substitute for, and in addition to, collateral guarantees and legal enforcement strategies.

With the exception of some moneylenders and other informal sources who may lend entirely out of their own funds, each of these financial service providers is typically an *intermediary*, financing loan advances using both their own capital as well as funds leveraged from other outside sources. They are in this sense also acting as delegate monitors for other outside investors. For example, a trader or input supplier may tap into credit advances from their own buyers or suppliers, from bank loans and overdrafts or via the discounting of bills. Larger enterprises such as agro-industrial or exporting firms may raise funds on national or international markets by selling stocks and bonds. Agricultural banks and cooperatives make loans out of own equity, but mostly using depositors' savings, or credit from other state or private lenders. Financial intermediation therefore can involve a long chain of monitored financial relationships with an investor at any given node in the chain only willing to onlend if they can be convinced that financial intermediaries further down the chain face the right incentives to carefully select and monitor borrowers and projects in ways that will uphold the value of the original investors' stakes.

Active monitoring takes many forms. For example, product traders and contract farming firms often release credit in installments timed to match the farmer's likely needs at different tasks over the crop season. An installment may be held up or sized down in response to farmer's actions to that date as perceived by the trader or company extension agent. Traders also typically make it their business to visit the farmer's fields at the time of harvest or during important input applications. Input suppliers in virtually all industries supply most of their trade credit to borrowers via in-kind loans rather than as cash advances -- seed, fertilizer, or a voucher for transport services will be delivered to

the farmer rather than cash (Burkart and Ellingsen 2004; Watts 1994) – and this too can be interpreted as a form of monitoring. These practices clearly aim at making it more difficult for borrowers to divert credit or other resources to other private uses or, more generally, to raise the borrower's expected return to being diligent rather than non-diligent. It is in part because of the possibilities of achieving such monitored lending relationships that contract farming schemes have often been heralded as a promising mechanism for financing small farmers (Glover and Kusterer 1990; Glover 1994; Watts 1994; Carter, Barham, and Mesbah 1996).

Consider again the simple model of moral hazard and limited liability. We can characterize the optimal contract by finding an allocation of consumption that maximizes borrower expected utility $\left[pc_0 + (1-p)c_1 \right]$ subject to incentive compatibility, limited liability and lender participation constraints. The limited liability constraint remains unchanged: $c_0 \geq -A$. Now assume, however, that a local lender or his delegate is in a position to monitor a borrower at a cost *m* in a way that lowers the borrower's opportunity cost of diligence from *B* to *b*<*B*.[7] If the borrower is monitored, the incentive compatibility constraint (1.8) becomes more relaxed to $c_1 \geq c_0 + \frac{b}{(p-q)}$. For the moment the monitoring agent might be anyone ranging from a microfinance loan officer to a local trader-moneylender. Whether or not they have capital of their own to put at risk in the borrower's lending project will make a difference, as analyzed below.

[7] This section adapts Holmstrom and Tirole (1997) which has become a workhorse model of sorts. A closely related interpretation of monitoring by Banerjee et al. (1994) is that monitoring increases the borrower's probability of success, or in terms of this simple model, that it raises *p* relative to *q*. These two interpretations are complementary and yield very similar results.

Since an outside investor is typically not in a position to directly observe his delegate's monitoring actions, the delegate's remuneration must be tied to outcomes on the borrower's project to create monitoring incentives. Consider first the case of a trader-moneylender or contract-farming firm that monitors a borrower at cost *m* and invests I^m of its own capital, leveraging the remaining $I^u = I - I^m$ from an outside bank to finance a borrower's loan of size *I*. Consider also a monitoring contract that promises to pay the monitor $m/(p-q) - I^m(1+r)$ if the borrower's project succeeds and $-I^m(1+r)$ if the borrower fails. That is, the monitor sinks the full opportunity cost of his funds and earns a reward only when the project succeeds. The expected *monetary* cost of using a delegated monitor is therefore

$$\frac{pm}{(p-q)} - I^m(1+r) \geq m \tag{1.12}$$

The inequality must hold if the monitor is to be willing to participate since *m* is the monitor's cost of participation (assuming zero reservation utility). From (1.12), and since $p/(p-q) > 1$, it is evident that the size of any delegation rent (i.e. expected payments in excess of the cost of monitoring *m*), and hence the total cost of delegating monitoring, increases with the size of *m* and can be lowered by asking the delegate to put more of their own capital I^m at risk.

Consider for the moment the case where $I^m = 0$, in which case the delegate has no capital of his or her own to place at risk. This would be the case of a typical loan officer who faces her own limited liability constraint that wage payments must be non-negative. Following again the steps leading to (1.11), but this time also considering the delegation rents needed to maintain monitor incentives, one arrives at a new minimum collateral requirement for the borrower, now as a function of *m*:

$$\underline{A}(m) = \frac{p(b+m)}{(p-q)} - [E[x \mid e^H] - I(1+r)] \tag{1.13}$$

As long as $(b+m) < B$, then monitoring lowers the minimum collateral requirement from $\underline{A}$ in (1.11) to (1.13), and therefore expands loan access to asset-poor borrowers over a range of monitoring. Note however that delegation costs $m/(p-q)$ increase the total cost of borrowing[8] so monitored loans will be chosen only by those borrowers who do not have enough collateral to access to pure (non-monitored) collateral-based loans. Those who do use monitored lending will choose a contract with only as much monitoring m as is minimally required to lower available collateral assets A to the minimum collateral requirement (i.e. to set $A = \underline{A}(m)$).

Several results that explain the operation and structure of rural financial markets can be derived by working within this kind of framework (Banerjee, Besley, and Guinnane 1994; Conning 1999; Holmstrom and Tirole 1997; Gine 2004; Varghese 2004). By directly reducing the borrower's scope for moral hazard, a delegated monitor may be able to attract relatively uninformed outside investors to help finance borrowers that these same outsiders would have otherwise found unprofitable. All else equal, delegate monitors without intermediary capital will however be more expensive to motivate than those with capital at risk. This is because putting capital at risk allows delegates to better commit to monitor, reducing the cost of providing monitoring incentives. This helps understand why already capitalized crop traders, shopkeepers and landlords are likely to emerge as local financial intermediaries. It also points to the possibility that rural

[8] The implicit interest rate for a borrower with assets A is $r + m/I(p-q)$ where m is given by $A = \underline{A}(m)$ in (1.13). Under the assumption of competition amongst lenders and intermediaries, any increase in the cost of monitoring is borne by the borrower who must cover any increase in participation costs by the intermediary.

financial intermediation may be held up not for lack of locally informed agents – these can generally be found and hired locally – but for lack of local intermediary capital (which, by definition, cannot be borrowed).

To see this more formally suppose that the monitor has assets to lend $I^m > 0$ out of own capital and offers outside investors senior claims to the borrower's project returns in the event of project failure. The outside investor now lends just $I^u = I - I^m$. It is easy to demonstrate that if the delegate puts up at least $I^m = qm/(p-q)$ then the delegation *rent* is eliminated and the cost of delegation is reduced to the cost of monitoring *m* and (1.13) becomes $\underline{A}(m) = pb/(p-q) + [EX - I(1+r)] + m$. This expands loan access and lowers the cost of funds to borrowers so monitored loan contracts will be cheaper and available to more borrowers where intermediary capital is more plentiful.

Whether or not intermediary capital is available, contracts will need to be more heavily monitored to reach poorer borrowers with fewer collateral assets, since the minimum monitoring intensity *m* that solves $\underline{A}(m) = A$ is higher for borrowers with less *A*. This in turn means that delegated monitors need to acquire a deeper financial stake (higher I^m) or, where that is not possible, that monitoring delegation costs must rise more quickly than the cost of monitoring *m*. It follows from this that financial institutions serving asset poor borrowers will also tend to be less highly leveraged (lower I^u/I) and generally have higher (monitoring) costs per dollar loaned compared to institutions serving borrowers who are able to offer more loan guarantees.

These last observations may also help explain the continued prevalence of informal moneylenders in rural areas who charge high interest rates even in what appear to be competitive loan markets. Moneylenders can be viewed as monitoring lenders who must

lend primarily out of their own equity (i.e. high I^m/I) and charge high interest rates in large part to recover monitoring costs. There is considerable empirical and case study evidence to support this characterization (Aleem 1990; Darling 1925). The less collateral that is available to borrowers in a community, the more intense is the required monitoring, and the larger the fraction of total lending that must be fronted by the monitor. Very marginal borrowers who have few or no collateral assets or proven cash flows will only be able to borrow from pure moneylenders, or friend and relatives (i.e. from individuals who lend entirely out of own equity and cannot become financial intermediaries in this context). This helps to explain the slow and uneven spread of commercial rural bank branching and other forms of intermediation into poor and undeserved communities. It also helps to explain why some rural microcredit lenders that specialize in lending to the poor have continued to rely on donor and government funds rather than tap into larger financial markets, even though they appear to be profitable and maintain very high repayment rates (Morduch 1999; Conning 1999). In a nutshell, the problem is that lenders' serving collateral-poor target groups cannot easily 'sell' or leverage any significant portion of their loan portfolio without diluting their own incentives to monitor and preserve the value of their loan portfolios.

Jain (1999) explores similar issues of formal-informal sector interaction in an adverse selection setting. Formal sector lenders are assumed to be able to mobilize funds at considerably lower cost than better-informed informal moneylenders, but formal lenders look for the presence of informal lending as signal or certification that the borrowers have been screened. Hence in both Jain's and the moral hazard context described above, formal and informal lenders compete but may also compliment each

other's lending activities. Several papers have tried to empirically identify the extent of formal-informal interaction, including Kochar (1997), Bell et al (1997), Conning (1996) and Hauge (1998). As in all econometric study of credit market behavior these studies face the challenge of identifying credit supply and demand in a market with rationing, with the added challenge that in this context loan demand may spillover from the formal to the informal sector. Both Key (1997) and more recently Gine (2004) provide an alternative by studying estimated structural models of credit supply with formal and informal lending. Gine's model, which is estimated using data from Thai villages, provides evidence to support the view that borrowers turn to the informal sector, not so much because they face fixed costs to formal sector borrowing but because of the limited ability of formal banks to enforce contracts in village communities.

Douglas Diamond's (1984) seminal work on financial intermediation clarified an important additional mechanism for lowering delegation rents which helps to further understand the opportunities and challenges faced by rural financial intermediaries. Although Diamond's original focus was on a model of costly state verification (ex-post moral hazard), his ideas carry over easily to the moral hazard example we are employing. Diamond's insight was to note that if a delegate were placed in charge of monitoring several loan projects rather than just one, and if returns from those different projects are imperfectly correlated, then the monitor can be made to cover the losses on one loan project out of the 'bonus' that would have otherwise been received for success on another monitored loan. The size of the delegation rent per loan can then be reduced and therefore also the size of either the minimum stake that an intermediary needs to place at risk to attract outside investors. Hence, financial intermediaries with more diversified

loan portfolios can achieve much higher levels of financial leverage, expand loan access, and lower the cost of borrowing.

To see this suppose that a loan agent with no initial capital ($I^m = 0$) were made to monitor *n* farm borrowers each with an identical but stochastically independent project. It can be easily shown[9] that the delegation rent per borrower can be lowered from $\frac{pm}{(p-q)}$ in expression (1.12) to $\frac{p^n m}{(p^n - q^n)}$ which quickly converges to *m* as the number of borrowers *n* is increased. In other words, a delegated monitor with no intermediary capital of her own can in principle reduce her costs per loan to the level of a less diversified monitor who does have intermediary capital by monitoring a sufficiently diversified portfolio.

A local intermediary is often a good monitor because he or she knows a lot about a narrow sector or geographic area. Unfortunately, the correlation across project returns within any such sector is likely to remain high, reducing the opportunities for incentive diversification opportunities identified by Diamond. This may explain why commercial financial intermediaries and microfinance have in general been much slower to penetrate into rural areas compared to urban areas where diversification is higher (Chaves and Gonzalez-Vega 1996), or why new microfinance ventures such as Grameen Bank have been more successful at funding rural non-farm activities than normal crop-cycle lending.

[9] See Conning (2004) or Laux (2001).

4.1 Crowding-in vs. Crowding-out of Financial Services

As we have seen, a rural financial intermediary may help to 'crowd-in' funds from less informed outsiders who where it not for the presence of these intermediary insiders might have found it unprofitable to contract directly with farm borrowers. A very general principle is at work here that Itoh (1993), Holmstrom and Milgrom (1990), Arnott and Stiglitz (1991), (Varian 1990) and others have noted and that is useful for understanding the role of intermediaries in the economy and for classifying models in the literature. Loosely stated, the principle is that if a group of agents can 'side-contract' amongst themselves to enforce actions or reward contingencies in ways that an outside principal would not have been able to specify in a contract, then it will generally be more efficient for the outsider to contract with the group (or the 'coalition') to try to harness the benefits of those side-contracts rather than to contract separately and independently with each agent.

The simpler financial intermediary structures of the last section -- with a lender, a delegated monitor/intermediary, and an agent – can be understood as applications of this general idea. The outside investor took advantage of the local intermediary's ability to 'side-contract' or 'monitor' the agent in ways that the outsider could not, allowing the investor to economize on the cost of providing indirect incentives.[10] A good part of the earlier literature on interlinked agrarian contracts should also be understood as applications of this very general idea (Braverman and Stiglitz 1982; Bell 1988).

[10]A difference is that in the previous section the agent and the intermediary did not *costlessly* and perfectly 'side-contract' as in the scenarios typically discussed in this earlier literature. It was worthwhile to work via a costly intermediary monitor only so long as the additional cost of delegation did not exceed the benefit it conferred. Conning (2004) provides a lengthier discussion of the different implications of models with costly versus costless 'side-contracting.'

The ability of agents to side-contract with other locally informed agents is *not* always helpful however. If agents can side-contract only on the same observable outcomes or actions that an outside financial institution could have included in the contract already, then side-contracts can never improve, and may possibly harm or 'crowd out', the agents' ability to access financial services. This is because side-contracts amongst agents potentially undermine incentives that a financial institution might have wanted to build into a contract. For example an outside lender may be reluctant to provide loan finance to a borrower if existing mutual aid arrangements within a village provide too much consumption insurance in states of the world when the financed project fails because this may undermine the repayment incentives the lender would like to have built into the loan contract. It is easy to construct examples where the inability to commit to not engaging in certain types of side contracts may lead to situations where outsiders hold back from providing new forms of efficiency-enhancing finance, yet at the same time the mere possibility that a new outsider might enter the market can crowd-out existing local contracting, leaving to the possibility of a decline in welfare.

The design of all financial intermediary structures and policies to promote financial intermediation can be thought of as involving decisions over which side-contracts to allow or to internalize within the institution, and which to try to disallow or regulate. A large number of papers, employing assorted types of information asymmetry problems, have been written that illustrate how certain types of unregulated competition between potential financial providers may end up 'crowding out' or shrinking the size of financial markets (Arnott and Stiglitz 1991; Kranton and Swamy 1999; Hoff and Stiglitz 1997; Navajas, Conning, and Gonzalez-Vega 2003; Wydick and Mcintosh 2004; Jain 1999;

Ray and Sengupta 1989). The issue has also been examined empirically in several studies, for example, Attanasio and Rios-Rull (2000) provide recent evidence that that the introduction of Mexico's PROGRESA public social safety net program crowded out local insurance. Morduch (1999) offers a review of some of the issues.

An important related implication is that in contexts where exclusive contracting is difficult or costly to enforce, competition may have a potentially destructive effect on the extent and depth of lending relationships. Petersen and Rajan (1995) argue for instance that loan sizes are larger in areas where banking is more concentrated because banks are more likely to be able to enter into long-term lending arrangements with an entrepreneur when there are fewer competing banks to poach away its more successful clients. Testing this idea, they find clear empirical evidence of a correlation between average loan size and bank concentration in US small-business lending.

This issue may be of potential great importance for explaining the pattern of agricultural lending in many contexts and why financial intermediaries including banks and agro-industry and contract-farming firms have not penetrated as deeply into some crops and regions as they have in others. Examining financing patterns in rural Chile, Conning (1996) points to an evident relationship between agro-industry processor concentration and lending depth. In crops such as tobacco or sugar beet where there was a single monopsony product buyer, agro industry contracts regularly financed 85-100 percent of small farmers' working capital needs, while in other crops such as tomatoes for canning or rice where several agroindustry firms or mills compete in any given region, contracts rarely financed more than 25 percent of small farmer costs. In less perishable crops with many potential buyers such as wheat and many types of legumes,

contract-farming firms are virtually non-existent, even though these are crops dominated by small farm producers. In interviews, product buyers attributed part of their reluctance to deeper financing to the fear of 'leakage' of that farmers who had pledged all or part of their harvest to a trader would surreptitiously divert part of their produce to another buyer. Jaffee (1994) underscores the importance of this perceived problem, concluding that the problem of 'leakage' had led to the termination of credit in a large Kenyan horticultural scheme. Runsten and Key (1996) document how similar contracting issues shaped the structure and success or failure of different Mexican contract farming schemes.

4.2 Group Loans, Cooperatives, ROSCAs, and Mutuals

No account of the history of rural lending would be complete without a mention of the role of credit-cooperatives, farm credit and insurance mutuals, and other 'group' lending and insurance mechanisms include solidarity group loans and Rotating Savings and Credit Associations. Although cooperative mutual society organizations such as these have been very important, and sometimes even dominant sources of finance to the rural economy, their relative importance has waxed and waned. In some cases early successes were marred by later spectacular failures.

The potential advantages of credit cooperatives, ROSCAs, savings mutuals and group loans can be explained as before by appealing to the idea that outside financiers may prefer to contract with a coalition in order to harness the ability of members of the group to side-contract using local information and enforcement mechanisms not available to outsiders. The group entity acts as a financial intermediary, helping to crowd in outside finance that wouldn't be available or as large via separate individual contracts. Stiglitz (1990), Varian (1990) and others have used this type of argument to explain why

joint-liability contracts to encourage costless 'peer-monitoring' within a group may provide advantages over separate individual-liability loans.[11] Greif (2004) and Levinson (2003) argue that forms of joint-liability contracting are in fact far more important and ubiquitous than economists normally realize. Greif argues that prior to the rise of impersonal, legally enforced exchange, most long distance trading arrangements were enforced for centuries via a communal responsibility system to harness this type of side-contracting and local enforcement mechanisms. Holmstrom (1999) argues that part of the reason for the existence of firms can be understood in similar terms.

Hansmann (1996) identifies other related reasons for the rise of savings and insurance mutuals in some contexts. He argues that the demand for insurance and savings vehicles grew as the frontier expanded and farming communities where established around the United States. Although private for-profit firms tried to offer products such as life insurance policies, farmers were reluctant to enter into such long-term relationships with private or stock-owned firms for fear that these firms might in the future act opportunistically, for example by raising insurance premiums or lowering promised payouts. With a mutual insurance company on the other hand, policyholders own the firm, so what a farmer might lose on his policy he gains back as a shareholder, so the incentive for the firm to act opportunistically is sharply reduced. The ownership/governance structure of the financial institution is therefore adapted to allow for better monitoring and incentives. As Hansmann points out, the mutual ownership form can hardly be dismissed as anachronistic or utopian ownership structures as even

[11] Surveys of the literature that discuss these concepts in the context of microfinance lending include Ghatak and Guinnane (1999), Morduch (1999), Ahlin and Townsend (2003), Conning (2004).

today insurance mutuals account for nearly half of all life insurance in force in the United States, and for trillions of dollars of insurance worldwide.

Credit cooperatives have also been important in the development of rural finance in many parts of the world. One of the most studied cases is that of the German credit cooperative movement which grew rapidly from a handful of small independent cooperatives in the mid 19th century to include over 19,000 cooperatives by 1914 (Guinnane 2001). Responding to popular demands the government passed cooperative legislation to both regulate and enable growth of the movement. In other countries governments introduced rural cooperative legislation in an effort to create new cooperative societies. The colonial government of India introduced legislation encouraging the development of agricultural cooperative credit societies in the late 19th century partly as a response to the Deccan Riots and the perception by some that rural informal moneylenders needed to forced to face more competition (Catanach 1970).

Although the overall record is mixed, credit cooperative systems and joint liability mechanisms serve an important role in the agricultural lending systems of many developing countries. One successful system is Thailand's Bank for Agriculture and Agricultural Cooperatives (BAAC), established in 1966. This government-sponsored system extends loans to farmers, farmer's groups and cooperatives and acts as a guarantor for loans or farm credits from other sources. For many years BAAC has used joint liability groups as a substitute for more traditional land collateral for small farm loans, managing to continue to expand rapidly while maintaining high repayment incentives (Townsend 1995).

Despite their prevalence and frequent success in agricultural financial markets, cooperatives and mutuals have at times failed spectacularly and are clearly not always optimal ownership or contract forms. Joint-liability (JL) clauses imply that each agent's net return in a group will be an *increasing* function of the performance of other agent's projects and loans. This creates incentives for 'peer-monitoring,' 'peer-selection,' and 'peer-sanction.' But in many contexts relative-performance evaluation (RPE) clauses may help to lower the cost of providing incentives. Relative performance works by making each agent's payoff a *decreasing* function of the measured performance on other agent's projects, the opposite of joint liability. A bank may for example want to extend a loan repayment grace period to a farmer who reports a bad harvest when many other farmers in the same region are reporting bad outcomes, but not otherwise, because the lender can then be more certain to be providing insurance against a common adverse shock, rather than possibly bailing out a farmer for failing to be diligent. When such considerations are important, ownership forms that imply joint liability are not likely to be optimal.

Joint or group liability forms are vulnerable to other problems as well. The most commonly discussed problem is the free-rider problem (Braverman and Guasch 1989; Kremer 1997; Holmstrom 1982). This occurs for example when agents are unable to efficiently side-contract to coordinate actions, as assumed in many of the models described above. In such a context a joint-liability structure may well encourage risk-taking or a lack of diligence, as each agent faces only a fraction of the cost of changes in their actions. The free-rider problem is more likely to matter the larger is the group. Partly because of the lack of attention to incentives and oversight, some government

sponsored agricultural cooperatives have failed to maintain repayment levels, sometimes resulting in later bailouts at great cost to the public. To anticipate and avoid such problems cooperative regulation and oversight exists in many countries that limits the amount of outside capital that cooperatives are allowed to raise. This is done so as to not dilute the incentives to monitor loans within the cooperative, but constrains cooperatives from growing very rapidly or responding to profit opportunities compared to other types of lenders.

4.3 Policies to promote rural financial intermediation

As the above review makes clear, there is plenty of theory and evidence to suggest that financial markets frequently fail to allocate resources in a first-best fashion. Financial contract forms and intermediary structures adapt to harness local information and enforcement mechanisms to ameliorate or overcome the problems created by information asymmetries and limited enforcement, but the solutions typically fall far short of first-best optimal.

Public policy can play an important role in affecting the provision of financial services in such environments, for better or for worse. Government can provide important basic infrastructure that is needed for the operation of markets. This includes providing effective government, and a system of laws and local courts to help facilitate the creation and enforcement of property rights and contracts. This is of course not always an easy accomplishment and, creating new forms of property may at times ironically even end up crowding out rather than crowding in financial trade unless other types of property rights are created at the same time. We have reviewed several examples of situations where innovations that may have spurred the entry of new

financial intermediaries started out well but over time led to crowding out, or in extreme cases, even to the collapse of some markets. The problem is that unless mechanisms exist for agents to enter into exclusive contracts, increased competition may undermine financial arrangements that had previously been self-enforcing. Things that help parties to overcome or lower the cost of such problems include efforts to make information public (such as the creation of credit bureaus) and enabling legislation and courts to notarize and register liens and collateral guarantees (Fafchamps 2004).

The prudential regulation of banks and non-bank financial institutions can play an important role in spurring financial deepening, although here again policy is a double edged sword and the potential to do more harm than good through heavy-handed intervention has been proven to be immense (Adams, Graham, and Von Pischke 1984). Dewatripont and Tirole (1994) work with a model very similar to the monitored lending framework described above, to illustrate how prudential regulation may 'crowd in' new forms of finance. Creditors and depositors may be more willing to invest in financial institutions if they see that regulatory or supervisory authorities are making sure that these intermediaries have the right incentives to carefully screen and monitor their borrowers. A government loan guarantee can similarly work to crowd-in private sector investment. The danger in all these mechanisms of course is that government involvement will create rather than ameliorate moral hazard, for example by encouraging banks and investors to take excessively large risks believing that the government will bail out the sector if things turn out badly. Excessively heavy regulation may easily stifle financial innovation and/or greatly raise the cost of financial services.

5 Conclusion

We have provided a brief overview of an enormous and rapidly-growing literature on rural financial markets in developing countries. The particular configurations of financial instruments and strategies that are available to rural households are extremely variable, making broad generalizations perilous. However, there is a great deal of evidence from a wide variety of rural settings that implies that financial markets are highly fragmented and imperfect. Borrowers are systematically sorted across different types of financial contracts according to their characteristics and activities. Even within single economies, the consequence is a great deal of diversity of contract form, and contract terms such as the interest rate are extremely variable.

Historically (indeed, as long as records exist) governments have intervened in rural financial markets, sometimes in a quite heavy-handed manner. The 1950s through the 1970s saw a cluster of policies that included interest rate ceilings and directed lending by state-owned and private banks being implemented in rural areas of many developing countries. A large literature on the associated *financial repression* arose that documented many of the deleterious effects of this type of intervention. Some of the fragmentation described in section 2.1 of this chapter may be among the consequences of this widespread financial repression.

However, the fundamental determinants of the myriad imperfections that afflict rural financial markets are the difficulties that arise in transactions of contingent promises when information is asymmetric and the enforcement of contracts is not assured. We have focused attention in the chapter on one particular form of asymmetric information that can have important consequences for shape of rural financial transactions – moral hazard. We hope that it is apparent that we have done so because it permits us to discuss

a wide range of important issues in the context of a single simple model, not because moral hazard is the only (or even necessarily the most important) source of asymmetric information. The core lessons that we draw from this exercise are applicable to the related contracting problems of adverse selection or opportunistic default.

In the 1980s and 1990s, structural adjustment programs adopted in many developing countries did away with many of the policies associated with financial repression. Although some promising financial innovations have taken place particularly in the realm of microfinance, most of this innovation has been focused on urban or non-farm rural activities. The response of the private agricultural financial system to these liberalizing policy changes was much less vigorous than many reformers had hoped. In order for a robust set of intermediated financial instruments to be available to rural households, government must do more than simply get out of the way of private lenders. There is a manifest need for careful state attention to the essential institutions that support rural financial intermediation.

Intermediation is more likely to emerge in situations in which new forms of financial contracts can be enforced. The range of contracts that is feasible can expand when institutions exist to facilitate the dissemination of information regarding market fundamentals (like growing conditions) or outcomes (like credit bureaus). Such institutions often, although not always, have the character of public goods and are unlikely to emerge in the absence of active state participation. A crucial focus of new research on rural financial markets must be the broad set of issues that surround the development of these intuitions of property rights, legal enforcement of financial contracts, and information diffusion.

Bibliography

Abreu, Dilip, David Pearce, and Ennio Stacchetti (1990), "Toward a Theory of Discounted Repeated Games with Imperfect Monitoring", *Econometrica* 58 (5):1041-1063.

Acemoglu, Daron, and Fabrizio Zilibotti (1997), "Was Prometheus Unbound by Chance? Risk, Diversification, and Growth", *Journal of Political Economy* 105 (4):709-751.

Adams, Dale W. (1992), "Taking a Fresh Look at Informal Finance", in, *Informal finance in low-income countries*, Boulder and Oxford, 5-23.

Adams, Dale W., Douglas H. Graham, and J. D. Von Pischke (1984), "Undermining Rural Development with Cheap Credit", in Dale- W. ed Adams, Douglas- H. ed Graham and J. D. ed Von-Pischke (eds.), *Undermining Rural Development with Cheap Credit. Westview Special Studies in Social, Political and Economic Development series*, Boulder, Colo., and London: Westview Press, 1-7.

Ahlin, Christian, and Robert M. Townsend (2003), "Using Repayment Data to Test Across Theories of Joint Liability Lending", in, *Vanderbilt Economics Department working paper*.

Akerlof, George A. (1970), "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism", *Quarterly Journal of Economics* 84 (3):488-500.

Aleem, Irfan (1990), "Imperfect Information, Screening, and the Costs of Informal Lending: A Study of a Rural Credit Market in Pakistan", *World Bank Economic Review* 4 (3):329-349.

Allen, Douglas W., and Dean Lueck (2002), *The nature of the farm : contracts, risk, and organization in agriculture*. Cambridge, Mass.: MIT Press.

Armendariz de Aghion, Beatriz, and Jonathan Morduch (2005), *The Economics of Microfinance*: MIT Press, forthcoming.

Arnott, Richard, and Joseph E. Stiglitz (1991), "Moral Hazard and Nonmarket Institutions: Dysfunctional Crowding Out or Peer Monitoring?" *American Economic Review* 81 (1):179-190.

Arrow, Kenneth, and Gerard Debreu (1954), "Existence of a Competitive Equilibrium for a Competitive Economy", *Econometrica* 22 (3):265-290.

Aryeetey, Ernest, and Chris Udry (2000), "Saving in Sub-Saharan Africa", in, *CID Working Paper No. 38, Harvard University*.

Attanasio, Orazio P. , and Jose Victor Rios-Rull (2000), "Consumption Smoothing and Extended Families", in, *University College London, working paper*.

Banerjee, Abhijit V. (2003), "Contracting Constraints, Credit Markets, and Economic Development", in Mathias Dewatripont, Lars Peter Hansen and Stephen Turnovsky (eds.), *Advances in Economics and Econometrics: Theory and Applications, Eighth World Congress, Volume III*, Cambridge, U.K.: Cambridge University Press.

Banerjee, Abhijit V., Timothy Besley, and Timothy W. Guinnane (1994), "Thy Neighbor's Keeper: The Design of a Credit Cooperative with Theory and a Test", *Quarterly Journal of Economics* 109 (2):491-515.

Banerjee, Abhijit V., and Esther Duflo (2004), "Do firms want to borrow more? Testing Credit Constraints Using a Directed Lending Program." in: MIT, Department of Economics.

Banerjee, Abhijit V., and Andrew F. Newman (1993), "Occupational Choice and the Process of Development", *Journal of Political Economy* 101 (2):274-298.

Bardhan, Pranab, ed. (1989), *The economic theory of agrarian institutions*. Oxford; New York; Toronto and Melbourne: Oxford University Press.

Bardhan, Pranab, and Chris Udry (1999), *Development Microeconomics*. New York: Oxford University Press.

Barry, Peter J., and Lindon J. Robison (2001), "Agricultural Finance: Credit, Credit Constraints, and Consequences", in, *Handbook of agricultural economics. Volume 1A. Agricultural production*, Amsterdam; London and New York: Elsevier Science, North-Holland, 513-571.

Basu, Kaushik (1992), "Limited Liability and the Existence of Share Tenancy", *Journal of Development Economics* 38 (1):203-220.

——— (1997), *Analytic Development Economics: The Less Developed Economy Revisited*. Cambridge, MA: MIT Press.

Bates, Robert H. (1981), *Markets and states in tropical Africa : the political basis of agricultural policies*. Berkeley: University of California Press.

Beegle, Kathleen, Rajeev Dehejia, and Roberta Gatti (2003), "Child Labor, Crop Shocks, and Credit Constraints", in, *NBER Working Paper 10088*.

Bell, Clive (1988), "Credit Markets, Contracts, and Interlinked Transactions", in H Chenery and T.N. Srinivasan (eds.), *Handbook of Development Economics. Vol. I.*, Amsterdam; London and New York: Elsevier Science, North-Holland, 381-423.

Bell, Clive, T. N. Srinivasan, and Christopher Udry (1997), "Rationing, Spillover, and Interlinking in Credit Markets: The Case of Rural Punjab", *Oxford Economic Papers* 49 (4):557-585.

Besley, Timothy (1994), "Savings, Credit and Insurance", in Jere Behrman and T.N. Srinivasan (eds.), *Handbook of Development Economics, Vol. III*, 2123-2207.

Binswanger, Hans P., and Mark R. Rosenzweig (1986), "Behavioural and Material Determinants of Production Relations in Agriculture", *Journal of Development Studies* 22 (3):503-539.

Boucher, Stephen, and M. R. Carter (2002), "Risk rationing in moral hazard constrained credit markets", in, Staff Working Paper #445, Agricultural and Applied Economics, UW-Madison.

Boucher, Stephen R., and Catherine Guirkinger (2004), "Risk, Wealth and Sectoral Choice in Rural Credit Markets", in, *Department of Agricultural Economics, University of California at Davis*.

Bowles, S. (2003), *Microeconomics:Behavior, Institutions, and Evolution*. Princeton: Princeton University Press.

Brasselle, Anne-Sophie, Frederic Gaspart, and Jean-Philippe Platteau (2002), "Land Tenure Security and Investment Incentives: Puzzling Evidence from Burkina Faso", *Journal of Development Economics* 67 (2):373-418.

Braverman, Avishay, and J. Luis Guasch (1989), "Institutional Analysis of Credit Co-operatives", in, *The economic theory of agrarian institutions*, Oxford; New York; Toronto and Melbourne, 340-355.

Braverman, Avishay, and Joseph E. Stiglitz (1982), "Sharecropping and the Interlinking of Agrarian Markets", *American Economic Review* 72 (4):695-715.

Burgess, Robin, and Rohini Pande (2003), "Do Rural Banks Matter? Evidence from the Indian Social Banking Experiment", in: Yale University, Dept. of Economics.

Burkart, Mike, and Tore Ellingsen (2004), "In-Kind Finance", *American Economic Review* 94 (3).

Carter, M.R., K.D. Wiebe, and B. Blarel (1994), "Tenure Security for Whom? Differential Effects of Land Policy in Kenya", in J.W. Bruce and S.E. Migot-Adholla (eds.), *Searching for Land Tenure Security in Africa*, Dubuque, Iowa.: Kendall/Hunt Publishing, 141-168.

Carter, Michael, B Barham, and Dina Mesbah (1996), "Agricultural export booms and the rural poor in Chile, Guatemala, and Paraguay", *Latin American Research Review* 31 (1).

Carter, Michael, Jeffrey Cason, and Frederic Zimmerman, eds. (1998), *Development at a Crossroads: Uncertain Paths to Sustainability After the Neoliberal Revolution, Global Studies Research Program*: University of Wisconsin-Madison.

Carter, Michael R., and Zimmerman Frederick J (2000), "The dynamic cost and persistence of asset inequality in an agrarian economy", *Journal Of Development Economics* 63 (2):265-302.
Carter, Michael R., and Pedro Olinto (2003), "Getting Institutions 'Right' for Whom: Credit Constraints and the Impact of Property Rights on the Quantity and Composition of Investment", *American Journal of Agricultural Economics* 85 (1):173-187.
Catanach, I. J. (1970), *Rural credit in western India, 1875-1930; rural credit and the co-operative movement in the Bombay Presidency*. Berkeley,: University of California Press.
Chaves, Rodrigo A., and Claudio Gonzalez-Vega (1996), "The Design of Successful Rural Financial Intermediaries: Evidence from Indonesia", *World Development* 24 (1):65-78.
Chiappori, Pierre Andre (forthcoming), "Econometric Models of Insurance under Asymmetric Information", ," in G Dionne (ed.), *Handbook of Insurance*: North Holland.
Coate, Stephen, and Martin Ravallion (1993), "Reciprocity without Commitment: Characterization and Performance of Informal Insurance Arrangements", *Journal of Development Economics* 40:1-24.
Cole, Shawn (2004), "Fixing Market Failures or Fixing Elections? Agricultural Credit in India", in, M.I.T. , Department of Economics working paper.
Conning, Jonathan (2004), "Monitoring by Delegates or by Peers? Joint Liability Loans under Moral Hazard", in, *Hunter College, Department of Economics, working paper*.
Conning, Jonathan H. (1996), *Financial Contracting and Intermediary Structures in a Rural Credit Market in Chile: A Theoretical and Empirical Analysis*. Yale University, Ph.D.
——— (1999), "Outreach, Sustainability and Leverage in Monitored and Peer-Monitored lending", *Journal of Development Economics* 60 (1):51-77.
Darling, Malcolm (1925), *The Punjab peasant in prosperity and debt*. London, New York etc.: H. Milford Oxford university press.
Dasgupta (1989), *Reports on Informal Credit Markets in India: Summary*. New Delhi: National Institute of Public Finance and Policy.
de Janvry, Alain, Marcel Fafchamps, and Elisabeth Sadoulet (1991), "Peasant Household Behaviour with Missing Markets: Some Paradoxes Explained", *Economic Journal* 101 (409):1400-1417.
de Soto, Hernando (2000), *The Mystery of Capital: Why Capitalism Succeeds in the West and fails almost everywhere else*. New York: Basic Books.
Deaton, Angus (1997), *The analysis of household surveys : a microeconometric approach to development policy*. Baltimore, MD: Published for the World Bank [by] Johns Hopkins University Press.
Deininger, K (2003), *Land Policies for Growth and Poverty Reduction*. Washington: World Bank, Oxford University Press.
Demsetz, Harold (1967), "Toward a Theory of Property Rights", *American Economic Review* 57 (2):347-359.
Dercon, Stefan (2004), "Growth and Shocks: evidence from rural Ethiopia", *Journal of Development Economics* (forthcoming).
———, ed. (2004), *Insurance against Poverty, WIDER Studies in Development Economics*: Oxford University Press.
Dercon, Stefan, and Pramila Krishnan (2000), "In Sickness and in Health: Risk Sharing within households in rural Ethiopia", *Journal of Political Economy* 108 (4):688-727.
Dewatripont, M., and Jean Tirole (1994), *The prudential regulation of banks, The Walras-Pareto lectures ; 1*. Cambridge, Mass.: MIT Press.
Diagne, Aliou, and Manfred Zeller (2001), "Access to credit and its impact on welfare in Malawi".
Diamond, Douglas W. (1984), "Financial Intermediation and Delegated Monitoring", *Review of Economic Studies* 51 (3):393-414.

——— (1996), "Financial Intermediation as Delegated Monitoring: A Simple Example", *Federal Reserve Bank of Richmond Economic Quarterly* 82 (3):51-66.
Duryea, S., D Lam, and D Levison (2003), "Effects of Economic Shocks on Children's Employment and Schooling in Brazil", in, Inter-American Development Bank, PSC Research Report 03-541.
Eswaran, M., and A Kotwal (1986), "Access to Capital and Agrarian Production Organization", *Economic Journal* 96:482-498.
Fafchamps, Marcel (1999), "Risk Sharing and Quasi-Credit", *Journal of International Trade and Economic Development* 8 (3):257-278.
——— (2003), *Rural poverty, risk and development*. Book, Whole vols. Cheltenham, UK ; Northampton, MA: E. Elgar.
——— (2004), *Market institutions in Sub-Saharan Africa : theory and evidence*. Book, Whole vols, *Comparative institutional analysis*. Cambridge, Mass. ; London: MIT Press.
Fafchamps, Marcel, and Susan Lund (2003), "Risk-Sharing Networks in Rural Philippines", *Journal of Development Economics* 71 (2):261-287.
Feder, Gershon, and David Feeny (1991), "Land Tenure and Property Rights: Theory and Implications for Development Policy", *World Bank Economic Review* 5 (1):135-153.
Felkner, John S., and Robert M. Townsend (2004), "The Wealth of Villages: An Application of GIS and Spatial Statistics to Two Structural Economic Models", in, *University of Chicago, Department of Economics working paper*.
Fellingham, John C., D. Paul Newman, and Yoon S. Suh (1985), "Contracts without Memory in Multiperiod Agency Models", *Journal of Economic Theory* 37 (2):340-355.
Field, Erica, and Maximo Torero (2004), "Do Property Titles Increase Credit Access Among the Urban Poor? Evidence from a Nationwide Titling Program", in, Harvard University working paper.
Fitchett, Delbert A. (1999), "Bank for Agriculture and Agricultural Cooperatives (BAAC), Thailand (Case Study)", in, Washington D.C.: Consultative Group to Assist the Poorest (CGAP) Working Group on Savings Mobilization.
Foster, Andrew D. (1988), *Why Things Fall Apart: A Strategic Analysis of Repeated Interaction in Rural Financial Markets*.
Freixas, Xavier, and Jean-Charles Rochet (1997), *Microeconomics of banking*. Cambridge, Mass.: MIT Press.
Fudenberg, Drew, Bengt Holmstrom, and Paul Milgrom (1990), "Short-term Contracts and Long-term Agency Relationships", *Journal of Economic Theory* 51 (1):1-31.
Galor, Oded, and Joseph Zeira (1993), "Income Distribution and Macroeconomics", *Review of Economic Studies* 60 (1):35-52.
(2001), Testimony before the Committee on the Agriculture, Nutrition, and Forestry, U.S. Senate. *Farm Loan Programs: Improvements in the Loan Portfolio but Continued Monitoring Needed*.
Genicot, Garance (2002), "Bonded Labor and Serfdom: A Paradox of Voluntary Choice", *Journal of Development Economics* 67 (1):101-127.
Genicot, Garance, and Debraj Ray (2002), "Endogenous Group Formation in Risk-Sharing Arrangements", *Review of Economic Studies* 70 (1).
Gersovitz, Mark (1988), "Saving and Development", in H Chenery and T.N. Srinivasan (eds.), *Handbook of Development Economics. Vol. I.*, Amsterdam; London and New York: Elsevier Science, North-Holland, 381-423.
Gertler, Paul, and Jonathan Gruber (2002), "Insuring Consumption Against Illness", *American Economic Review* 92 (1):51-76.
Ghatak, Maitreesh , and Timothy W. Guinnane (1999), "The Economics of Lending with Joint Liability: A Review of Theory and Practice", *Journal of Development Economics* 60 (1).

Ghate, Prabhu (1992), "Informal finance: Some findings from Asia", in, Oxford; New York; Toronto and Hong Kong: Oxford University Press for the Asian Development Bank.
Gine, Xavier (2004), "Access to Capital in Rural Thailand: An estimated model of formal versus informal credit." *World Bank Policy Research Working Paper No. 3502*.
Gine, Xavier, and Stefan Klonner (2003), "Financing a New Technology in Small-scale Fishing: the Dynamics of a Linked Product and Credit Contract", in, The World Bank Research Group, manuscript.
Glover, David (1994), "Contract Farming and Commercialization of Agriculture in Developing Countries", in Joachim von-Braun and Eileen eds Kennedy (eds.), *Agricultural commercialization, economic development, and nutrition*, Baltimore and London: Johns Hopkins University Press for the International Food Policy Research Institute, 166-175.
Glover, David, and Ken Kusterer (1990), *Small farmers, big business: Contract farming and rural development*. New York: St. Martin's Press.
Goetzmann, William N. (1996), "Financing Civilization", in, Yale School of Management.
Goldstein, Markus (2004), "Intrahousehold Efficiency and Individual Insurance in Ghana", in, *London School of Economics working paper*.
Goldstein, Markus, and Chris Udry (1999), "Agricultural Innovation and Resource Management in Ghana", in, Yale University, Department of Economics working paper.
Gonzalez-Vega, Claudio (1984), "Credit-Rationing Behavior of Agricultural Lenders: The Iron Law of Interest-Rate Restrictions", in, *Undermining Rural Development with Cheap Credit*, 78-95.
Greif, Avner (1993), "Contract Enforceability and Economic Institutions in Early Trade: the Maghribi Traders' Coalition", *American Economic Review* 83 (3):525-548.
——— (2004), "Impersonal Exchange without Impartial Law: The Community Responsibility System", *Chicago Journal of International Law* 5 (1):107-136.
Grimard, Franque (1997), "Household Consumption Smoothing through Ethnic Ties: Evidence from Cote D'Ivoire", *Journal of Development Economics* 53 (2):391-422.
Grossman, Herschel I., and John B. Van Huyck (1988), "Sovereign Debt as a Contingent Claim: Excusable Default, Repudiation, and Reputation", *American Economic Review* 78 (5):1088-1097.
Grossman, Sanford J., and Oliver D. Hart (1983), "An Analysis of the Principal-Agent Problem", *Econometrica* 51 (1):7-45.
Guinnane, Timothy W. (2001), "Cooperatives As Information Machines: German Rural Credit Cooperatives, 1883-1914", *Journal of Economic History* 61 (2):366-389.
Gurley, John G., and Edward Stone Shaw (1960), *Money in a theory of finance*. Washington,: Brookings Institution.
Hansmann, Henry (1996), *The Ownership of Enterprise*. Cambridge: Harvard University Press.
Hart, Oliver, and Bengt Holmstrom (1987), "The Theory of Contracts", in Truman- F. ed Bewley (ed.), *Advances in economic theory: Fifth World Congress. Econometric Society Monographs series, no*, 12, Cambridge; New York and Melbourne: Cambridge University Press, 71-155.
Hauge, Soren (1998), "The Outreach Impact and Sustainability of Group-Based Credit: Empirical Evidence from Rural Chile", *University of Wisconsin, Ph.D.*
Hazell, P. B. R., Carlos Pomareda, and Alberto Valdes (1986), *Crop insurance for agricultural development : issues and experrience*. Baltimore: Published for the International Food Policy Research Institute by the Johns Hopkins University Press.
Hoff, Karla, Avishay Braverman, and Joseph Stiglitz, eds. (1993), *The Economics of Rural Organization: Theory, practice, and policy*. Oxford; New York; Toronto and Melbourne: Oxford University Press for the World Bank.

Hoff, Karla, and Joseph E. Stiglitz (1997), "Moneylenders and Bankers: Price-Increasing Subsidies in a Monopolistically Competitive Market", *Journal of Development Economics* 52 (2):429-462.

Holmstrom, Bengt (1979), "Moral Hazard and Observability", *Bell Journal of Economics* 10 (1):74-91.

——— (1982), "Moral Hazard in Teams", *Bell Journal of Economics* 13 (2):324-340.

——— (1999), "The firm as a subeconomy", *Journal of Law, Economics and Organization* 15:74-102.

Holmstrom, Bengt, and Jean Tirole (1997), "Financial Intermediation, Loanable Funds, and the Real Sector", *Quarterly Journal of Economics* 112 (3):663-691.

Hueth, Brent, and Ethan Ligon (2001), "Agricultural Markets As Relative Performance Evaluation", *American Journal of Agricultural Economics* 83 (2):318-328.

Innes, Robert (1993), "Financial Contracting under Risk Neutrality, Limited Liability and Ex ante Asymmetric Information", *Economica* 60 (237):27-40.

Innes, Robert D. (1990), "Limited Liability and Incentive Contracting with Ex-ante Action Choices", *Journal of Economic Theory* 52 (1):45-67.

Itoh, Hideshi (1993), "Coalitions, Incentives, and Risk Sharing", *Journal of Economic Theory* 60 (2):410-427.

Jacoby, H., and E. Skoufias (1997), "Risk, Financial Markets, and Human Capital in a Developing Country", *Review of Economic Studies* 64 (3).

Jaffee, Steven M. (1994), "Contract Farming in the Shadow of Competitive Markets: The Experience of Kenyan Horticulture", in Peter- D. Little and Michael- J. eds Watts (eds.), *Living under contract: Contract farming and agrarian transformation in sub Saharan Africa.*, Madison: University of Wisconsin Press, 97-139.

Jain, Sanjay (1999), "Symbiosis vs. Crowding-Out: The Interaction of Formal and Informal Credit Markets in Developing Countries", *Journal of Development Economics* 59 (2):419-444.

Jalan, J., and M. Ravallion (1998), "Transient poverty in postreform rural China", *Journal of Comparative Economics* 26 (2):338-357.

Jensen, Robert (2000), "Agricultural Volatility and Investments in Children", *American Economic Review* 90 (2):399-404.

Jeong, Hyeok, and Robert M. Townsend (2003), "Growth and Inequality: Model Evaluation Based on an Estimation-Calibration Strategy", in, University of Chicago, Department of Economics working paper.

Kandori, Michihiro (1992), "Social Norms and Community Enforcement", *Review of Economic Studies* 59:61-80.

Karlan, Dean, and Jonathan Zinman (2004), "Observing Unobservables: Identifying Information Asymmetries with a Consumer Credit Field Experiment", *Princeton Economics Department working paper*.

Kazianga, Harounan (2004), "Consumption Smoothing? Livestock, Insurance and Drought in Rural Burkina Faso", in, Yale University, Department of Economics working paper.

Key, Nigel (1997), *Modeling and Estimating Agricultural Household Behavior under Imperfect Markets*University of California, Berkeley.

Kimball, M. (1988), "Farmer Cooperatives as Behavior Toward Risk", *American Economic Review* 78:224-232.

Kletzer, Kenneth, and Brian Wright (2000), "Sovereign Debt as Intertemporal Barter", *American Economic Review* 90:621–639.

Klonner, Stefan (2004), "Buying Fields and Marrying Daughters: An Empirical Analysis of Rosca Auctions in a South Indian Village", in: Department of Economics, Cornell University.

Knoeber, Charles R., and Walter N. Thurman (1994), "Testing the Theory of Tournaments: An Empirical Analysis of Broiler Production", *Journal of Labor Economics* 12 (2):155-179.
Kochar, Anjini (1997), "An Empirical Investigation of Rationing Constraints in Rural Credit Markets in India", *Journal of Development Economics* 53 (2):339-371.
——— (1999), "Smoothing Consumption by Smoothing Income: Hours-of-Work Responses to Idiosyncratic Agricultural Shocks in Rural India", *Review of Economics and Statistics* 81 (1).
Kocherlakota, N (1996), "Implications of Efficient Risk Sharing without Commitment", *Review of Economic Studies* 63:595-609.
Kranton, Rachel E., and Anand V. Swamy (1999), "The Hazards of Piecemeal Reform: British Civil Courts and the Credit Market in Colonial India", *Journal of Development Economics*.
Kremer, Michael (1997), "Why are Worker Cooperatives so Rare?" in: National Bureau of Economic Research Working Paper: 6118.
La Ferrara, Eliana (2003), "Kin Groups and Reciprocity: A Model of Credit Transactions in Ghana", *American Economic Review* 93 (5):1730-1751.
Laffont, Jean-Jacques, and David Martimort (2003), *The principal agent model: The economic theory of incentives*: Princeton University Press.
Lambert, Richard A. (1983), "Long-term Contracts and Moral Hazard", *Bell Journal of Economics* 14 (2):441-452.
Laux, Christian (2001), "Limited-Liability and Incentive Contracting with Multiple Projects", *RAND Journal of Economics* 32 (3):514-526.
Levinson, Daryl (2003), "Collective Sanctions", *Stanford Law Review* 56 (345).
Ligon, Ethan, J.P. Thomas, and Tim Worall (1999), "Mutual Insurance with Limited Commitment: Theory and Evidence from Village Economies", in, *working paper, University of California, Berkeley*.
Ligon, Ethan, Jonathan P. Thomas, and Tim Worrall (2002), "Informal Insurance Arrangements with Limited Commitment: Theory and Evidence from Village Economies", *Review of Economic Studies* 69 (1):209-244.
Loury, Glenn C. (1981), "Intergenerational Transfers and the Distribution of Earnings", *Econometrica* 49 (4):843-867.
Macho-Stadler, and Perez-Castrillo (2001), *An Introduction to the Economics of Information: Incentives and Contracts*. 2nd ed: Oxford University Press.
Madajewicz, Malgosia (2004), "Does the Credit Contract Matter? The Impact of Various Lending Programs on Poverty in Bangladesh", in, *Department of Economics, Columbia University*.
Matsuyama, Kiminori (2002), "Explaining Diversity: Symmetry-Breaking in Complementarity Games", in, *American Economic Review*, 241-246.
Matthews, Steven A (2001), "Renegotiating Moral Hazard Contracts under Limited Liability and Monotonicity", *Journal of Economic Theory* 97 (1):1-29.
McCloskey, Donald (1976), "English Open Fields as Behavior towards Risk", *Research in Economic History*:124-170.
McKenzie, David, and Christopher Woodruff (2004), "Do Entry Costs Provide an Empirical Basis for Poverty Traps? Evidence from Mexican Microenterprises", in, Stanford University, Department of Economics working paper.
McKinnon, Ronald (1973), *Money and Capital in Economic Development*. Washington, DC: Brookings Institution.
Meyer, Richard L., and Geetha Nagarajan (2000), *Rural financial markets in Asia : policies, paradigms, and performance, [A study of rural Asia ; v. 3]*. Oxford ; New York: Oxford University Press.
Meyer, Richard L., Geetha Nagarajan, and Leroy J. Hushak (1997), "Segmentation in the Philippine Informal Credit Markets: A Multinomial Logit Analysis", in Roger Rose,

Carolyn Tanner and Margot- A. eds Bellamy (eds.), *Issues in agricultural competitiveness: Markets and policies. International Association of Agricultural Economists Occasional Paper, no. 7. Aldershot, U.K*, and Brookfield, Vt.: Ashgate, pages 258-266.

Mirrlees, James A. (1976), "The Optimal Structure of Incentives and Authority within an Organization", *Bell Journal of Economics* 7 (1):105-131.

Mookherjee, Dilip (1984), "Optimal Incentive Schemes with Many Agents", *Review of Economic Studies* 51 (3):433-446.

——— (1997), "Wealth effects, incentives and productivity", *Review of Development Economics* 1 (116-133).

Mookherjee, Dilip, and Debraj Ray (2003), "Persistent Inequality", *Review of Economic Studies* 70 (2):369-393.

Morduch, Jonathan (1995), "Income Smoothing and Consumption Smoothing", *Journal of Economic Perspectives* 9 (3):103-114.

——— (1999), "The Microfinance Promise", *Journal of Economic Literature* 47 (4).

——— (1999), "The Role of Subsidies in Microfinance: Evidence from the Grameen Bank", *Journal of Development Economics* 60 (1):229-248.

Navajas, Sergio, Jonathan Conning, and Claudio Gonzalez-Vega (2003), "Lending Technologies, Competition and Consolidation in the Market for Microfinance in Bolivia", *Journal of International Development* 15 (6):747-770.

Ngugi, R.W. (2001), "An empirical analysis of interest rate spread in Kenya", in, *African Economic Research Consortium (AERC)*.

North, Douglass Cecil (1990), *Institutions, institutional change, and economic performance*. Cambridge ; New York: Cambridge University Press.

North, Douglass, and Robert Thomas (1973), *The Rise of the Western World: A New Economic History*. Cambridge: Cambridge University Press.

Paulson, Anna L., and Robert M. Townsend (2003), "Distinguishing Limited Commitment from Moral Hazard in Models of Growth with Inequality", in: Federal Reserve Bank of Chicago.

Pender, John L., and John M. Kerr (1999), "The Effects of Land Sales Restrictions: Evidence from South India", *Agricultural Economics* 21 (3):279-294.

Petersen, Mitchell A., and Raghuram G. Rajan (1995), "The Effect of Credit Market Competition on Lending Relationships", *Quarterly Journal of Economics* 110 (2):407-443.

Place, Frank, and S.E. Migot-Adholla "The Economic Effects of Land Registration on Smallholder Farms in Kenya: Evidence from Nyeri and... DE - FARMS -- Kenya DE - LAND titles -- Registration & transfer SO - Land Economics PD - Aug98, Vol. 74 Issue 3, p360 PG - 14p".

Platteau, Jean-Philippe (1997), "Mutual Insurance as an Elusive Concept in Traditional Rural Communities", *Journal of Development Studies* 33 (6):764-796.

Rajan, Raghuram, and Luigi Zingales (2003), *Saving capitalism from the capitalists : unleashing the power of financial markets to create wealth and spread opportunity*. 1st ed. Book, Whole vols. New York: Crown Business.

Ravallion, Martin, and Shubham Chaudhuri (1997), "Risk and Insurance in Village India: Comment", *Econometrica* 65 (1):171-184.

Ray, Debraj (1998), *Development economics*. Princeton, N.J.: Princeton University Press.

Ray, Debraj, and Kunal Sengupta (1989), "Interlinkages and the Pattern of Competition", in Pranab ed Bardhan (ed.), *The economic theory of agrarian institutions*, Oxford; New York; Toronto and Melbourne: Oxford University Press, 243-263.

Ray, Tridip, and Nirvikar Singh (2001), "Limited Liability, Contractual Choice, and the Tenancy Ladder", *Journal of Development Economics* 66 (1):289-303.

Rosenzweig, Mark R., and Oded Stark (1998), "Consumption Smoothing, Migration, and Marriage: Evidence from Rural India; Consumption Smoothing, Migration, and Marriage: Evidence from Rural India", in, *Economic demography.Volume 2*, Cheltenham, U.K. and Northampton, Mass.: Elgar; distributed by American International Distribution Corporation, Williston, Vt., 592-613.

Rozensweig, M, and K Wolpin (1993), "Credit Market Constraints, Consumption Smoothing, and the Accumulation of Durable Production Assets in Low-income Countries: Investment in Bullocks in India", *Journal of Political Economy* 101 (2):223-244.

Runsten, David, and Nigel Key (1996), "Contract Farming in Developing Countries: Theoretical aspects and analysis of some Mexican Cases", in: Report prepared for the United Nations Economic Commission for Latin America and the Caribbean, Santiago, Chile.

Sadoulet, Elisabeth, Alain de Janvry, and Seiichi Fukui (1997), "The Meaning of Kinship in Sharcropping Contracts", *American Journal of Agricultural Economics* 79 (2):394-406.

Salanié, Bernard (1997), *The economics of contracts : a primer*. Cambridge: MIT Press.

Schündeln, Matthias (2004), *Firm Dynamics in the Presence of Financing Constraints: Ghanaian Manufacturing*. Economics DepartmentYale University.

Scott, James C. (1976), *The moral economy of the peasant : rebellion and subsistence in Southeast Asia*. New Haven: Yale University Press.

Sen, Amartya (1982), *Poverty and Famines: An Essay on Entitlement and Deprivation*: Oxford University Press.

Shetty, Sudhir (1988), "Limited Liability, Wealth Differences and Tenancy Contracts in Agrarian Economies", *Journal of Development Economics* 29 (1):1-22.

Siamwalla, Ammar (1990), "The Thai Rural Credit System: Public Subsidies, Private Information, and Segmented Markets", *World Bank Economic Review* 4 (3):271-295.

Singh, Inderjit, Lyn Squire, and John Strauss (1986), *Agricultural Household Models: Extensions, Applications, and Policy*. Baltimore & London: Johns Hopkins University Press.

Spillman, W. J. (1919), "The Agricultural Ladder", *American Economic Review* 9:170-179.

Srinivasan, T.N. (1989), "On Choice Among Creditors and Bonded Labour Contracts", in, *The economic theory of agrarian institutions*, Oxford; New York; Toronto and Melbourne: Oxford University Press, vi, 408.

Stiglitz, Joseph E. (1974), "Incentives and Risk Sharing in Sharecropping", *Review of Economic Studies* 41:397-426.

——— (1990), "Peer Monitoring and Credit Markets", *World Bank Economic Review* 4 (3):351-366.

——— (1994), "The Role of the State in Financial Markets", in, *Proceedings of the World Bank Annual Conference on Development Economics, 1993: Supplement to The World Bank Economic Review and The World Bank Research Observer.*, Washington, D.C.: World Bank, 19-52.

——— (2002), "Information and the Change in the Paradigm in Economics", *American Economic Review* 92 (3):460-501.

Stiglitz, Joseph E., and Andrew Weiss (1981), "Credit Rationing in Markets with Imperfect Information", *American Economic Review* 71 (3):393-410.

Suri, Tavneet (2003), "Spillovers in Village Consumption: Testing the Extent of Partial Insurance", in, Yale University, Department of Economics working paper.

Thiele, Henrik, and Achim Wambach (1999), "Wealth Effects in the Principal Agent Model", *Journal of Economic Theory* 89 (2):247-260.

Timberg, Thomas A., and C. V. Aiyar (1984), "Informal Credit Markets in India", *Economic Development and Cultural Change* 33 (1):43-59.

Tirole, Jean (forthcoming), *The Theory of Corporate Finance*.

Townsend, Robert M. (1979), "Optimal Contracts and Competitive Markets with Costly State Verification", *Journal of Economic Theory* 21 (2):265-293.

——— (1993), *The medieval village economy: A study of the Pareto mapping in general equilibrium models, Frontiers of Economic Research series*. Princeton: Princeton University Press.
——— (1994), "Risk and Insurance in Village India", *Econometrica* 62 (3):539-591.
——— (1995), "Consumption Insurance: An Evaluation of Risk-Bearing Systems in Low-Income Economies", *Journal of Economic Perspectives* 9 (3):83-102.
——— (1995), "Financial Systems in Northern Thai Villages", *Quarterly Journal of Economics* 110 (4):1011-1046.
——— (2003), "Microcredit and Mechanism Design", *Journal of the European Economic Association* 1 (2-3):468-477.
Udry, Christopher (1991), *Rural Credit in Northern Nigeria*. Department of Economics, New Haven: Yale University.
——— (1994), "Risk and Insurance in a Rural Credit Market: An Empirical Investigation in Northern Nigeria", *Review of Economic Studies* 61 (3):495-526.
Udry, Christopher, and Esther Duflo (2004), "Intrahousehold Resource Allocation in Côte d'Ivoire: Social Norms, Separate Accounts and Consumption Choices," in, Yale University, Department of Economics working paper.
Varghese, Adel (2004), "Bank-Moneylender Linkages as an Alternative to Competition", *Oxford Economic Papers*.
Varian, Hal R. (1990), "Monitoring Agents with Other Agents", *Journal of Institutional and Theoretical Economics* 146 (1):153-174.
Von Pischke, J D , Gordon Donald, and Dale W. Adams (1983), *Rural Financial Markets in Developing Countries: Their Use & Abuse*: Johns Hopkins Univ Press.
Von Pischke, J. D. (1997), "The Financial Systems Approach to Development Finance and Reflections on Its Implementation", in, working paper.
Warning, Matthew, and Elisabeth Sadoulet (1998), "The Performance of Village Intermediaries in Rural Credit Delivery under Changing Penalty Regimes: Evidence from Senegal", *Journal of Development Studies* 35 (1):115-138.
Watts, Michael J. (1994), "Life under Contract: Contract Farming, Agrarian Restructuring, and Flexible Accumulation", in Peter- D. Little and Michael- J. eds Watts (eds.), *Living under contract: Contract farming and agrarian transformation in sub Saharan Africa.*, Madison: University of Wisconsin Press, 21-77.
World Bank (1975), "Agricultural Credit: Sector Policy Paper", in, Washington, DC: World Bank Agricultural Policies Division.
Wydick, Bruce, and Craig Mcintosh (2004), "Competition and Microfinance", *Journal of Development Economics*.
Zeller, Manfred (2003), "Models of Rural Financial Institutions", Paper read at Paving the Way Forward for Rural Finance An International Conference on Best Practices, at Washington, DC.
Zeller, Manfred, Aliou Diagne, and Charles Mataya (1998), "Market Access by Smallholder Farmers in Malawi: Implications for Technology Adoption, Agricultural Productivity and Crop Income", *Agricultural Economics* 19 (1-2):219-229.